The Journal
OF THE
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Evening Meeting.

Monday, June 14th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAME of MEMBER who joined the Institution between the 7th and 14th June, 1869.

ANNUAL.

Bridson, T. R., Capt. 7th Royal Lanc. Militia, 1*l*.

"THE LAUNCH OF H.M.S. 'NORTHUMBERLAND.'"

By Rear-Admiral Sir JOHN C. DALRYMPLE HAY, Bart., C.B., M.P., F.R.S., &c.

SIR JOHN HAY: The circumstances of my appearing before this meeting to read this paper is one that, perhaps, deserves some apology. The fact is, that not only in looking over the records of this Institution, but in looking over other records, I found abundance of information as to the process of building ships, and a great deal of information as to what we ought to do with a ship after she is launched, but the actual process of transferring the ship from the place on which she is built to the water, is nowhere described, scientifically. It is described, of course, in various forms in newspapers, where we see accounts of the launches of ships; but there is no information available for an Officer or any person engaged in ship-building, who wishes to ascertain how actually to launch a ship, as to what the arrangements for a launching are. It so happened that I had something to do with the launch of the "Northumberland" some years ago; and when I was endeavouring to describe it to my friends, and was anxious to describe accurately what had passed, I found when I came to reduce it to writing,

the truth of Lord Bacon's famous maxim, that "speaking makes one a ready man, reading makes one a learned man, and writing makes one an exact one." I found when I came to reduce this account to writing that I was not at the first attempt so exact as I could have wished. Therefore, I am extremely happy to see one gentleman present this evening to whom I am indebted, Mr. Luke, a gentleman connected with the Admiralty, who gave me a great deal of technical information; in fact, almost the whole of the technical information embodied in this paper, and enabled me exactly to describe what occurred. All I claim credit for is, the having reduced that information into a form in which I thought it might be useful to this Institution to put on their records, so that anybody having such heavy bodies as this ship to move under such exceptional circumstances, might be able to refer to those records for information on that point. I claim no further originality for the paper than that. With the permission of the meeting, I will now read the paper which I have drawn up with the assistance of Mr. Luke, and which I presented to the Council of this Institution some time ago, to be placed on their records.

The launch of Her Majesty's Ship "Northumberland" is the subject which I propose to describe this evening. It has a twofold interest.

Firstly, because of the immense weight successfully set in motion, and

Secondly, because of the mechanical contrivances by which that motion was obtained and controlled.

No doubt many whom I address are far more competent than I am to illustrate such a subject, but as circumstances placed me in a position to watch the building of that ship, and in some degree to aid in her successful launch, I am perhaps more able than most people to relate the transaction.

In the year 1861, it was decided to build three iron-clad ships of such a size that no difficulty would exist in clothing them completely with thick iron armour.

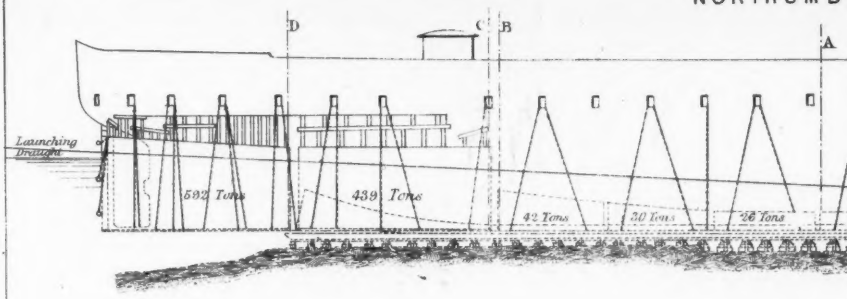
Up to this time our largest ships, such as the "Warrior" and the "Black Prince," were only armour-clad in that portion of the ship in which the guns are usually mounted; and about 170 feet in length, part at the bow and part at the stern, was not coated with iron armour. This mode of construction was adopted to relieve the extremities of the ship from a weight which would have made her much less buoyant and safe at sea. But in order to protect the ship from being easily sunk by shot which might penetrate the bow or stern, the ship was divided into many compartments, so that only those which were perforated should fill with water.

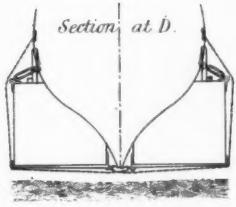
These compartments were in themselves a source of weight, and rendered the ship less convenient than if less subdivided.

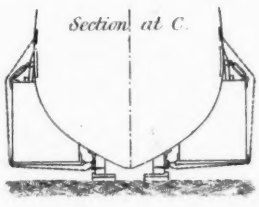
It was found that by increasing the tonnage of the "Warrior's" class by about 600 tons, ships might be built completely armoured, and yet in all respects fit for sea.

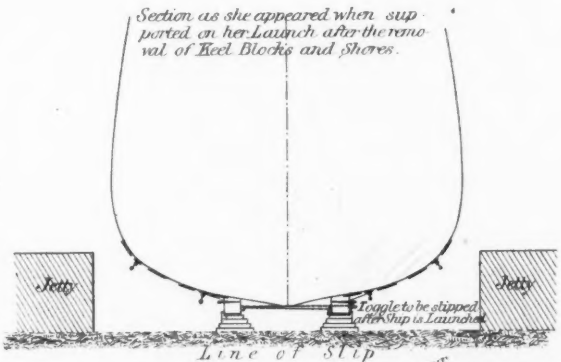
For this purpose the "Minotaur," the "Agincourt," and the "Northumberland" were commenced in 1861.

NORTHUMB



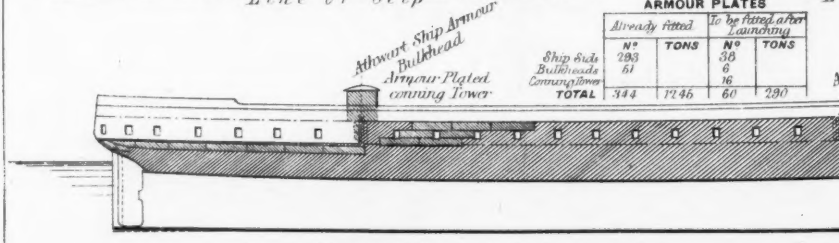





Section as she appeared when supported on her Launch after the removal of Keel Blocks and Shores.
Jetty
Jetty
Toggle to be stipped after Ship is Launched
Line of Slip

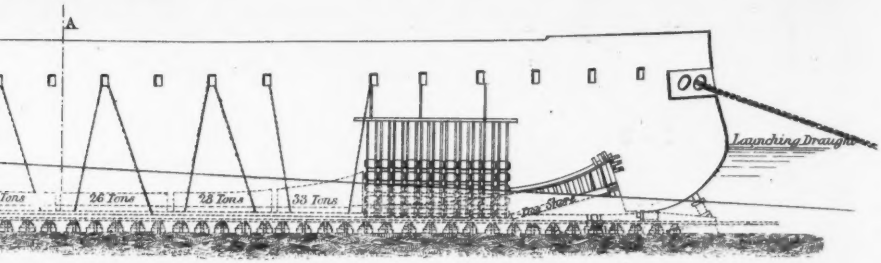
ARMOUR PLATES

	Already fitted		To be fitted after Launching	
	N°	TONS	N°	TONS
Ship Sides	283		38	
Bulkheads	61		6	
Conning Tower			16	
TOTAL	344	1746	60	290

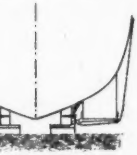


Armour Plates worked on the Ship when Launched ..... *thus*
Do to be fitted to complete the Ship after Launching ..... *"*
Scale 1/4 of an Inch = 1 Foot

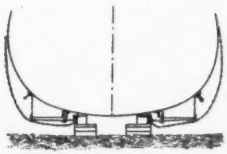
THUMBERLAND.



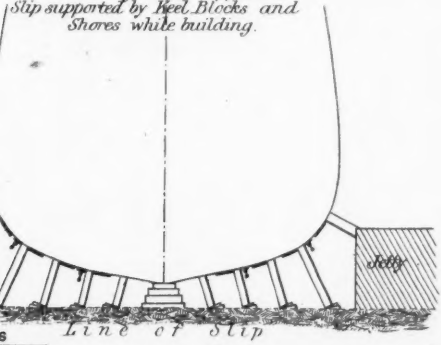
ction at B.

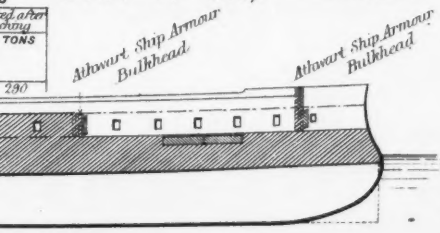


Section at A.

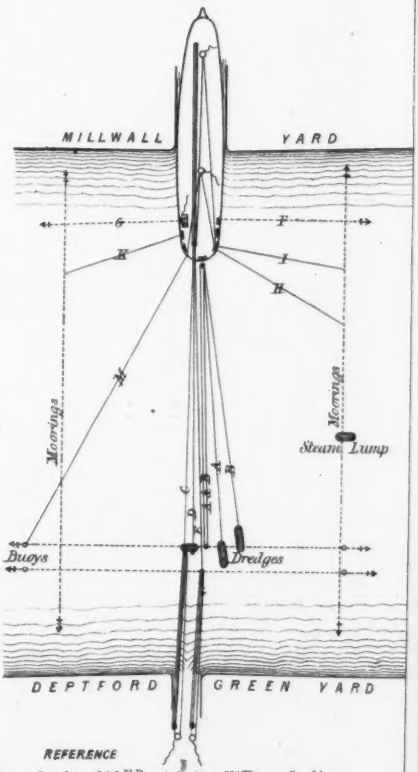


Section Shewing how she appeared on Slip supported by Keel Blocks and Shores while building.





thus



REFERENCE

A Steam Dredger 300 H.P. to take in a 13" Hawser Double
B " " From Chatham " "
C A 23" Cable from Ship with threefold purchase in Deptford-
D Green Dockyard and Lump to keep up Hawsers
E A 23" Cable to moorings hove in aboard "Northumberland"
F G 2 Lines of Battle Ships Bower chains secured to quarters to hold her when the pontoons or Camels begin to lift
H J 2 13" Cables to moorings hove in upper deck Capstans on board Northumberland" to keep her in line of launch
K A 12" Do Do Do Do
L A Steam Lump 10" Hawser to be hove in on board as she goes off
M A 10" Cable to buoys ready for reaving in at Capstan on board Northumb.

J. Jobbins

I shall now describe these ships, which are almost identical, though some slight changes were made at a late date in the arrangement of the armour of the "Northumberland," by reducing the weight of some of her armour at the extremities, in order to enable the authorities to increase her armament by giving this ship very heavy guns.

The length of the "Northumberland" is	400 feet
Breadth, extreme	59 ft. 3½ in.
Depth of hold, *i.e.*, lower deck to keel	21 ft. 1 in.
Total depth	42 ft.
Tonnage—builder's measurement..	6,621 tons
Horse power of engines, nominal	1,350 h.p.
Mean load draught	25 ft.
Height of portsill from water	9 ft.
Armour-plated below water	6 ft.
Propeller, Griffith's, four-bladed, diameter	24 ft.
Pitch .. .. 28 ft. 6 to	22 ft. 6 in.
Armour-plates, 5½ inches, tapering to 3 inches forward and aft. and 2 inches under the counters. The wood backing of teak being 9 inches thick amidships, and tapered to 6 inches forward and aft.	
Weight of armour-plates on the ship when launched ..	1,247 tons
Making the total weight launched	7,100 tons

This difference, however, is to be observed in the three ships:—

The "Minotaur" was launched from the Thames Iron Works with only 440 tons of armour-plates on her sides. The rest were added after she was water-borne and in the basin.

The "Agincourt" was built and completed by Messrs. Laird in a dry dock, and was floated out of it when complete.

The "Northumberland" was armour-clad (all but a few plates) before launching, and thus was the heaviest body ever moved along a single launch.

I say a single launch, because the "Great Eastern" was launched on several ways, and was built broadside on the river, so that the keel was at right angles to the launch; whereas the "Northumberland" was launched stern foremost in the ordinary manner.

And here it may be advisable that I should endeavour to describe, in language as devoid of technicality as possible, the process of launching a ship.

Ships are generally built on blocks of wood or piles placed at short distances, on which the keel is laid.

The upper surfaces of these blocks are placed so as to show a continuous inclination or declivity of from ½ an inch to ⅝ths of an inch in the foot.

The keel thus slopes towards the water at the inclination best suited to the condition and depth of water of the river or harbour that is to receive the ship. If the vessel is small and short, and the water deep, there is every advantage in a rapid descent. If the vessel is large

and heavy, then a slower and more gradual launch is more desirable, and the more so when, as in the case of the "Northumberland," the vessel was so long and the water so shallow, that a descent at too great an angle might have caused the stern post of the ship to strike the bottom of the river before the bow was clear of the slip, and the vessel fairly afloat.

Well, as I have said, ships are generally built on piles or blocks placed at an angle, and as the structure rises on each side of these blocks, and the sides of the ship are formed, it is supported by shores or props of timber, the lower end of each resting on the bottom or sides of the slip or dock in which the ship is being built, and the upper end against a portion of the side of the ship.

Each shore is made to receive its fair share of the weight of the ship by means of wedges driven in at the heels of the shores.

When the ship has been completed to a fit state for floating or launching, her weight has then to be transferred from the blocks on which her keel has hitherto rested, and from the shores which support her sides, to the sliding-ways down which she is intended to be launched, into what is called, rather inappropriately, her native, but more justly her adopted element.

On each side of the blocks on which the keel is resting are other piles or blocks, and on them are built the sliding-ways. These are formed of thick plank, the whole made strong enough to bear the weight of the ship.

The outer edges of the sliding-ways are placed so that the whole shall be a little wider than one-third of the extreme breadth of the ship, or one-sixth of the extreme breadth of the ship on each side of the keel. This arrangement makes it obviously impossible for a ship to tumble over on her side.

Under the ship is built a cradle with a smooth under surface resting on the smooth upper surface of the sliding-ways.

So long as the ground and cradle are not crushed or compressed, the ship must be firmly balanced.

For the cradle, on any given side, would only have one-third outside and two-thirds on the other side to hold it.

Persons unacquainted with the principles and practice of launching ships, often express their surprise when they first see so much of a ship apparently unsupported, and overhanging its cradle, and very naturally entertain fears lest she should topple over; but as above explained there can be no danger.

The sliding-ways for large ships of ordinary weight are each from $2\frac{1}{2}$ to $3\frac{1}{2}$ feet broad (in the "Northumberland's" case they were $3\frac{1}{2}$ feet broad), and their inclination and declivity are governed by the size of the ship, rise and fall of tide, depth of water, and other circumstances, which the person responsible for the launch has to consider before he determines the degree of inclination at which the ship is to be built and launched.

The sliding-ways, as already described, have about five-eighths of an inch to the foot of inclination, and in many cases this is arranged to increase as it approaches the water. This construction is adopted

partly to give a camb or curve to the centre of the ways to obviate any tendency to sink there from the weight of the ship, and partly to assist the ship in her descent into the water, as the immersion of a part of the ship has a tendency to arrest her progress into the water.

In the case of the "Northumberland," the higher end of the sliding-ways had an inclination of $\frac{6}{10}$ths of an inch to the foot. At the centre $\frac{65}{100}$ths, and at the lower end about $\frac{3}{4}$ of an inch to the foot.

On the outer edge of the sliding-ways are fixed what are called "ribbands," to keep the ship in the proper line for launching, and to prevent the cradle from slipping off the slides.

The upper surface of the sliding-ways, or fixed ways, and the under side of the bilge-ways, or moving ways, are thickly coated with melted tallow, oil, and patches of soft soap. The bilge-ways are then placed on the sliding-ways, the two greased surfaces coming together.

The space between the top of the bilge-ways and the bottom of the ship is filled in amidships with solid pieces of fir timber, and forward and aft with shores or vertical pieces of timber called poppets, their lower ends resting on planks, which again rest on broad oak wedges, placed nearly close together, the whole length of the cradle, on the inside next the keel, and on the outside next the ribband between the solid plank and the bilge-ways.

When the cradle has thus been formed and completed, and it is time to prepare for launching, these wedges are simultaneously driven in by a very large number of shipwrights with mauls (or large iron hammers), and the weight of the ship by the power of these wedges, is thus transferred, from the keel blocks and shores on which the ship since her commencement has hitherto rested, to the cradle resting, as already shown, on the sliding-ways.

On each side of the cradle near the bow, is a large piece of timber, with one end against the bilge-ways, and one end against the sliding-ways, and these two act as pauls to hold the ship up to the moment of launching. They are called the dog-shores.

When nearly time for launching, the keel blocks (with the exception of three or four left to assist the dog-shores in preventing the ship moving too soon down the sliding-ways) and the shores are removed, and the ship is then suspended on the cradle ready for launching.

When the time arrives for launching, which is generally about a quarter of an hour before high water, to ensure launching at slack water, the dog-shores are simultaneously knocked away, and the ship slides down the greased incline-planes into the water.

As soon as the ship is afloat, the cradle, which is not fastened to the bottom of the vessel, floats up from underneath and the ship is free. For these remarks as to the general nature of a launch, I must apologize, observing that they will make it much more easy to understand what is now to follow.

I must beg of you therefore to imagine H.M.S. "Northumberland" prepared for launching in the mode I have endeavoured to describe. It was the 17th of March, 1866. The Prince of Wales and a gay and joyous company had assembled to see the "Northumberland" enter the Thames from her slip in the Millwall Ironworks.

Just before high water, the dog-shores were knocked away; the Countess Percy bestowed the highest title of her house upon the ship, and after some pressure from hydraulic rams the "Northumberland" commenced her descent into the river. At first she seemed to move sluggishly, but gradually her pace increased, then some hesitation, and then after having moved 178 feet, she suddenly came to a stand-still. The cheering crowd were all silenced. Dismay was pictured in every countenance.

The company at length dispersed; but for a month the failure to launch the "Northumberland" was a general topic of discussion, and during that period measures which eventually proved successful were gradually matured by the officers of the Millwall Company, assisted by the able advisers whom the Admiralty placed at their disposal, by the efforts cordially made by the Royal Dockyards in the Thames, and by the goodwill and hearty co-operation of the workmen at Millwall and the officers, seamen, and marines who assisted them.

When the tide left, it was seen that the afterpart of the bilge-ways had only gone about 25 feet beyond the sliding-ways, and that the ship rested securely on her cradle without straining. No harm was likely therefore to happen to so strong a structure; and in fact none did arise, as the ship only deflected $\frac{7}{16}$ths of an inch in 342 feet, after she stopped until she was finally launched.

From this time forth every inventor in the country had nostrums to suggest, and it was not for lack of counsel that the "Northumberland" remained immovable for a month. Above 400 plans for releasing her were submitted to the persons connected with the undertaking. Many suggested gunpowder as a means of blowing her off into the river. Some suggested lifting by means of balloons, and one actually proposed to fill her with gas, and so to allow her to lift herself off the slip on which she was built. A proposal was made in sober earnest to fill the dock with peas, which opening and expanding in the water would lift the ship and allow her to glide down their smooth and swollen surfaces.

A countryman of mine well known and of considerable chemical reputation, came to me one morning, and I must do him the justice to say, gratuitously tendered me his advice. I was busily engaged watching the operations when I was told that a gentleman wished to see me. After a close examination and some preliminary conversation, he said, "Sir John, if you'll alloo me I'll tell ye hoo to get her off. Ye know what the mainsail of a ship's made o'—stoot number-one canvass. Well, jist tak a great wab o' that and spread it oot across the river. Attach the two corners to the dock, and to the ither two corners attach two quick river steamers. Make them steam swiftly to the shore. They'll roll in a great volume of water. It will float the ship and the returning wave will jist set her doon whar ye want her—in the river." I thanked my kind friend, and promised if present arrangements failed, to consider his proposal.

At high water on the 18th of March attempts were made by means of hydraulic rams, tugs, capstans, and other appliances, to haul her off, but as might have been expected without success.

It was then decided to postpone any further attempts to launch her till the next spring tides, and in the meantime to remove and re-grease a portion of the launch at the forepart, and to provide means for lifting the ship between the afterpart and midships, so as to lighten her and raise her weight off the ways where it was believed that the grease had been squeezed and burnt out by the friction. It seemed certain that owing to the great and continuous pressure, the surfaces of the bilge-ways and sliding-ways had been brought into cohesion so that it was necessary to tear them asunder, and it was also desirable to throw the weight on the newly greased ways at the forepart of the launch.

Blocks and shores were accordingly again placed under the ship to support her.

About fifty feet in length of the fore part of the launch was removed, this length of slides re-greased and launch replaced, and a new or supplementary launch was built inside the bilge-ways forward, which was also continued for the whole length of the sliding-ways. This was done for the purpose of giving an increased surface, and so diminishing the friction.

Twelve camels or pontoons were built, having a total lifting power of 370 tons, and placed under the after portion of the midship body of the ship. Eight mooring lighters, with a total lifting power of about 400 tons, were placed under the counters, and lashed down at low water by chains passed under the keel. A hydraulic ram, with a pushing power of 800 tons, was placed against the stem of the vessel, and two of 450 tons-power each, were placed, one on either side, to push against the fore ends of the cradle. Cables from lighters in the river were brought to capstans on board, and a steam-dredge moored in the river brought a cable from the ship to her drum, which, with the addition of several powerful steam tugs, were to assist in hauling her off.

These arrangements were completed by the 30th March, and on the 2nd April an attempt was made by these means to move the ship. They failed however to do so.

The difficulty of bringing an equal strain on the chains which attached the mooring lighters caused some of them to snap; thus the comtemplated assistance from the lighters was not obtained, and the camels, which acted admirably, had not sufficient lifting power.

None of the means applied had however been wasted; and except the chains which lashed the lighters, no useless expense had been incurred. It was evident that the reliance which could not be placed upon vessels or lighters, might fairly be placed on camels or pontoons. The lighters could not be closely lashed to the ship, and immense strain was therefore brought upon the chains which attached them, whereas the form of the camel could be adapted exactly to that of the ship, and the pressure of the water but attached it more firmly.

It was therefore decided to incur the additional expense of building four more very large camels, and to fit them to the after part of the ship, and also to support the ship again on blocks and shores as before, and shift as much more of the launch as could possibly be got at with safety.

By this means about 125 feet additional length of launch was renewed and re-greased, making 175 feet in all. Four large camels were built and secured under the quarters with a total lifting power of 2,000 tons. On each side, an additional hydraulic ram was placed against the fore end of each supplementary cradle, making altogether five hydraulic rams, with a pushing power of 2,400 tons.

Two steam-dredges were moored in the river astern of the ship. To each a 13-inch cable was brought, which was taken from them, passed through blocks lashed low down on the stern-post, and brought to their respective drums. Two 23-inch cables were taken from the ship to lighters moored in the river, which each supported large blocks, through which threefold purchases were rove and brought to capstans in Deptford Green-yard.

Another 23-inch cable was taken to moorings in the stream, and hove in by a threefold purchase on board the "Northumberland." Two line-of-battle ship's chains were secured to the quarters of the ship to keep her in line, if the pressure of the tide should tend to slew her. Two 13-inch cables on the starboard quarter, exposed to the tide, were brought to the upper deck capstans in the ship for the same purpose. A 12-inch cable on the port quarter for a similar purpose. A steam lump was also provided with a 10-inch hawser to gather in and hold the ship when it was necessary to slip all those which have been described; and another 10-inch cable was ready at the buoys to warp her to her place when safely afloat.

In case the tide should be high, as it proved to be, and the ship with all these means of flotation and motive power should become too lively, her bower-chains were attached to anchors in the yard, ready to slip at the moment of launching—and two hydraulic rams of 400 tons each, were placed under the forefoot, at such an angle as to offer some resistance to the ship's moving. They also were to serve another purpose. For being pressed upwards with great force against the ship it was calculated that by relaxing them suddenly the ship might be shaken on the ways and thus assisted in freeing herself.

In order that no means might be neglected, the space under the ship forward was filled with casks lashed low down so as to assist in lifting.

Furthermore, it was surmised that the ground-ways would rise with the ship as they were relieved of the enormous pressure under which they had so long groaned. To ascertain whether this were so, it was at first proposed to employ a diver, but the risk to life and limb would have been considerable, and two plans were devised to obtain this information. The one by Mr. Lungley the manager of the works, the other by Mr. Luke the accomplished Admiralty Officer who had superintended the assistance given by that department.

The first was composed of two fine chains, one attached to the sliding-way, the other to the ground-way, the ends brought up and rove through two pulleys adjusted to equal lengths and with weights attached to each. So long as the ship rose and the weights continued to descend, *pari passu*, it would be shown that the ground-ways were springing up and still pressing against the bilge-ways. So soon as

the weight attached to the bilge-ways began to descend more than the other, it would be shown that a separation had at last taken place.

The other was a long graduated wedge with its fine edge adjusted exactly opposite to the opening between the two ways. A long lever worked by a handle was fitted so as to force it into the opening when it should be able to receive it, while the arc described by the lever registered the amount of separation as shown by the wedge. Both of these instruments answered their purpose and gave the necessary information.

Another precaution was taken. Valves were fitted in each camel, so that if owing to a high tide the ship should become too lively and too buoyant, then water could be admitted at pleasure into the camels, and their flotation regulated as might be desired.

The 16th of April was the day fixed for the launch; but one chain had not been properly secured, and it was deemed right to delay until the 17th. It was fortunate that it was so, for the enormous crowd that had assembled both in the dockyard and on the river, made it almost certain that some accidents of a serious character would occur.

The crowd, much disappointed, did not return in such numbers on the following day, though a sufficient number were there to witness the successful effort.

On the 17th the tide flowed to a considerable height, and at an hour and a half before high water, the instruments already described began to show that the ship was beginning to lift.

It had been decided beforehand that when a separation of one inch and a-half had been shown to have taken place between the bilge-ways and the sliding-ways, at the junction of the old and new ways, water should then be let into the camels to maintain this amount of separation.

From about an hour before high water then, water was gradually admitted to the camels, and so carefully, that the just separation was exactly maintained. Meantime all the cables were hove taut, and the ship longing to be free, was straining at her cable and grinding at the dogshores, like an impatient horse chafing at the bit. It would not do, however, to let her go; for an impetuous tide was still sweeping across her course, which if she had been allowed to enter, would have twisted her on the ways, and perhaps made her a complete wreck.

At last the tide slackened, the chains were slipped, the pressure on the rams under the forefoot was removed, the dog-shores were successfully knocked away, and the ship herself gently glided into the Thames. So ended this long and anxious labour, and the narrator of this, who had some opportunity during the process of encouraging the despondING, and stimulating his fellow-labourers, had the satisfaction to hear his name mingled with the vociferous cheers of those who had watched his endeavours and shared in his success.

The CHAIRMAN: Should any gentleman present wish to ask Sir John Hay any question, or elicit further information on the subject before us, I am sure that he will be glad to give it.

Commander W. DAWSON, R.N.: I rise to make a few remarks, not with the view of

eliciting information, but with the view of congratulating the Institution on the fact that an Officer of the distinguished abilities of Sir John Hay has come forward to give us exact information upon a subject upon which we younger Officers require some instruction. In my younger days I remember that in the midshipmen's berth the most popular books read were Harris's *Heaving Down Ships*, Key's *Recovery of the Gorgon*, Tinmouth's *Points of Seamanship*, our friend Sir Edward Belcher's *Nautical Surveying*, and other such professional works. I have always felt that we very much want records of the means employed in the actual performance of exceptional professional feats, such as that described by Sir John Hay. The Journal of this Institution, to a limited extent, supplies that *desideratum*, but I should like to see it do so still more. In one of the recent Journals there is a most valuable paper (carrying out the suggestion which I have ventured to throw out) from Admiral Inglefield, who described what the profession would never have otherwise known, viz., "the tactical performances of the Mediterranean Fleet." Now Sir John Hay has brought before us the details of a subject, on which younger Officers required information, and for which they will owe him many thanks. It is a point on which exact information is very much wanted. We cannot lay hold of a book in which to find detailed information with reference to the launching of ships. Though all of us read at the time with great interest the newspaper accounts of the launching of the "Northumberland," yet there are a great many additional professional details which Sir John has brought before us to-day, which it is most desirable to place on permanent record, and which I am sure will be read by the Officers of the different ships to which our Journal goes, with very great interest. My only regret is, that Officers with the experience of Sir John Hay, who have had the actual superintendence of exceptional seamanlike undertakings of this kind, do not more frequently come forward to describe them with such fulness of reliable detail for the instruction of younger Officers. I would venture to throw out a suggestion to the Council, whether it would be possible to induce the Admiralty to encourage Officers of the Fleet to supply information regarding any exceptional work that they might be engaged upon, for the benefit of their less fortunate brother Officers. Naturally Officers cannot furnish such information without the permission of the authorities, and they may perhaps be too modest to ask for that permission, unless positive encouragement be given on the part of the Admiralty to supply it. It is only those Officers who have actually had the conduct of such work, who can really supply the exact detailed information which is required, and which I am sure we shall all feel the need of when the day of trial comes, when we are called upon to carry out works of a similar nature.

Admiral Sir EDWARD BELCHER: Some allusion has been made in the paper to peas. I do not think Sir John Hay has fairly dealt with the question. The letter that I wrote upon the question of these peas had no reference whatever to placing the peas in the dock. There is a certain *modus operandi* by which you may deduce an enormous power from very trivial means. We know that no direct power that you can exert will rend millstones. But if we adopt the proper and simple power, that is, by using wedges of willow, baked and deprived of moisture, and drive them into ridges or channels cut round each stone, and allow water to flow down over the top (by the very same action), during the night the capillary tubes are filled and the courses are found to be separated. No one sees the separation in action, but it is known to take place from capillary action. In a similar way the Portuguese separate immense pieces of granite, as long as this room (20 to 30 feet in one piece), by the use of very small iron wedges, and very slight taps with the hammer. The Chinese also pursue the same course. After I wrote the letter alluded to, I took the trouble to have a set of cylindrical instruments constructed of sheet zinc, and at the following meeting of the British Association I placed it on the table of Section G, at Nottingham, and with one pint of peas I raised 1 cwt. one inch in twelve hours. Consequently, one cubic foot will raise 5,824 lbs. (or 2·6 tons). And if the power of the peas had been exerted in a proper manner, fairly brought into play, the "Northumberland" might have been moved. But the question was not whether she should be moved one inch, but a series of inches; and that result must have been carried out by a series of tubes, those tubes not exceeding 4½ inches in diameter. I would venture to say that by the

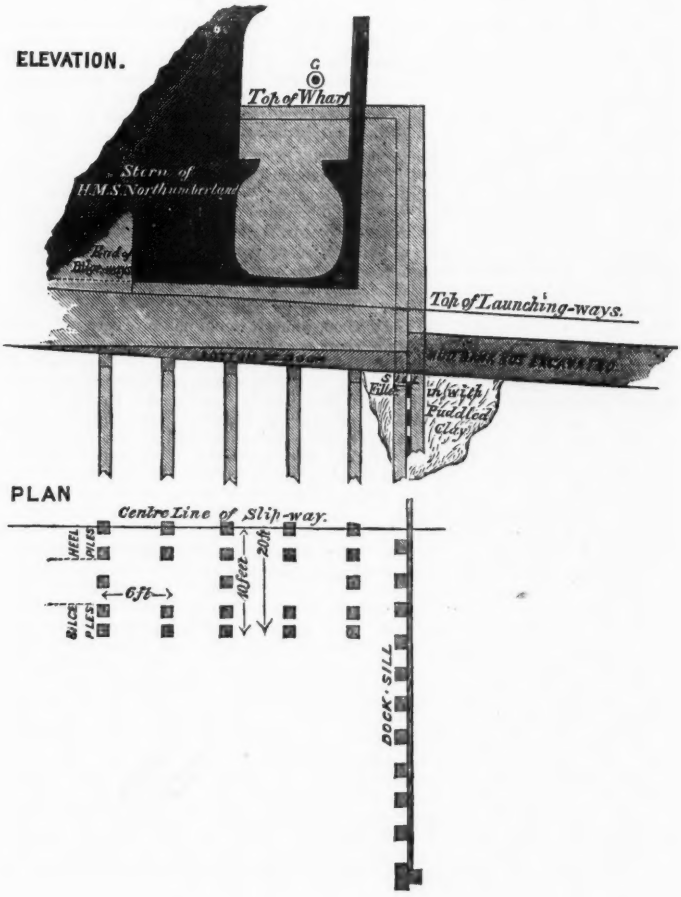
use of peas,* by mustard seed, or sawdust, a greater lifting or lateral power can be exerted than you can possibly gain by any mechanical powers that are known to you. Consequently the question of peas is not quite so ridiculous. I have the same implements at home; and if any one would like to see the experiment tried, I shall be happy to show them.

Mr. C. F. Henwood, N.A.: Before Sir John replies, I should like to make one or two remarks, inasmuch as the slip-way was built after my own plans, and the "Northumberland," herself laid down under my direction. A good deal of criticism passed at the time of launching this ship, as to the cause of her not being launched, as it was hoped she would be. If you will allow me, I have here a sketch of the slip-way and ship, which I think will enable me to explain readily the circumstances, and save a good deal of talking. I should like first to state the reasons for building the "Northumberland" in an excavated slip-way, or partial dock, and not as the "Minotaur." The "Minotaur" was built on, and was launched from the ordinary height, the same as the "Himalaya," and other merchant ships. In the case of the "Northumberland" it was contemplated to build over her an iron roof, the same as we have in all Her Majesty's dockyards. It became necessary, therefore, to build this large ship as low down as possible, so as not to require a greater height of roof than was absolutely necessary. That was one reason. Then we had another reason, and that was a commercial one, viz., we wished to utilize this slip-way after launching the "Northumberland" as a slip-way for hauling up ships for repairs, for the cost of it was between £7,000 and £8,000, which it would not have been judicious to have incurred for merely one ship. These were the principal reasons for building this slip-way or partial dock. The land is very treacherous; in fact, most of it is what is termed "made ground." It is not very solid, and the weight of the ship to be built upon it was very great. Moreover, it was intended to put on the whole of the armour-plating before launching; it therefore became necessary to compute the weight of the ship at the time for launching, and to give a sufficient foundation to support this great weight. The following sketch shows you the elevation and plan of the piles under the ship, and at the sill. The ship in building was supported on rows of 9 and 7 piles alternately, 6 feet apart throughout its length. This ship being built in a semi-dock, a coffer-dam had to be built at the entrance, and made perfectly water-tight. The sill was supported by a series of piles from side to side, planked and filled in with puddled clay, and was made considerably stronger than the slip-way. Now about the launching—all the circumstances were thoroughly studied when preparing the slip-way and the blocks for building the ship upon. The incline of this slip-way is three-quarters of an inch in the foot, and that of the blocks half an inch in the foot. In preparing this plan, I provided for giving the launching ways three-quarters of an inch declivity in the foot, if necessary. The actual declivity given was somewhat less, but I should not have been satisfied myself with less than ¾ in. in the foot. Yet I think, under the circumstances, there is no reason to doubt that there was a sufficient declivity given. Now, let me explain the cause of her stopping on the "ways." In launching, the ship rests in her cradle on the bilge-ways, which are supported on a series of blocks laid on the top of the bilge-piles. The ship then being chiefly supported by them,—and they afforded a uniform, but to a certain extent an elastic support,—there was not the same amount of rigidity in them as there was in the sill of the dock, and I found that in laying the launching-ways, blocks for their support were also laid on the *sill of the dock*, which should not have been done. I firmly believe that this error was the sole cause of her stopping on the ways; and I think you will see with me that that must have been the case, the launching-ways at the sill being more rigidly supported than at any other part.

Note.—It was found, further, that peas, after having exerted this enormous power were not injured, and were, in fact, from the heat evolved, in a state of advanced vegetation, and on trial bloomed and bore fruit!

A cubic foot of space can only support (*less the weight of the material which encloses it*) 42·5 lbs. of fresh, or 46·4 salt water.—E. B.

The position of the "Northumberland" in the dock before she started is shown in the sketch. Taking the centre of gravity of the weight of the ship at launching to be



at about 200 feet from after side of rudder port, G, would represent its position when she stopped; thus you will see that the centre of gravity of the ship was just before that very rigid part the sill, and thus the whole weight of the ship, over 7,000 tons, bore on that one part, which acted as a powerful break to stop the ship. If a plan had been devised to stop the ship when gliding down that declivity,

nothing could have been devised more efficient than what was done in this case by pure accident, because the whole weight of the ship was grinding on that one part. And that the friction was *enormous* is proved by what Sir John Hay told us, that even with the great depth of water over it, he saw clouds of smoke coming up. The heat there was very great. The wood was charred, and pressed out in a most extraordinary manner. This is my explanation, and I think it is a valid one, of the cause of the "Northumberland" not launching. It was the simple accident of supporting the ways on the sill. If they had not been thus supported, I believe the ship would have gone off satisfactorily. Yet that greater declivity might have been given, I will now show. This slip-way was only built as far as the sill while the ship was building; the part outside was left until the time for launching. The perhaps too frequent change of Officers in connection with the Company induced the mishap; for it appears that the Officers last in charge of the works were not fully cognizant of what had taken place previously, nor with the general plan of this slip-way; as they made the launching-ways, outside the dock, on the top of the mud-bank, which it was intended to remove, therefore they practically diminished the declivity of the slip-way. Now if that mud-bank had been excavated as intended, it would have been very easy to have given a declivity of three-fourths of an inch to the foot.

Sir JOHN HAY: I am sure we are all very much obliged to Mr. Henwood for the further explanation he has given us. I have no doubt he is quite accurate in the statement he has made. He is much more capable of giving that information than I am; and probably he would be right in the view he has taken. Perhaps Mr. Luke would say whether that is his view, because he is a very practical man, and would know.

Mr. LUKE: I would prefer to leave this question to Mr. Lungley, who is now present, and who was manager of the work at the time. It is a question I would rather not give an opinion upon, beyond stating that I do not agree with Mr. Henwood that what he stated was the sole cause of the stoppage.

Mr. HENWOOD: I did not mean to say the sole cause in the sense that there might not have been some minor impediment.

Mr. LUKE: I beg your pardon; I understood you to say that was the sole cause. It might have helped it, but I do not think it was the sole cause.

Mr. HENWOOD: The principal cause.

Mr. LUKE: I do not even agree with you there, that it was the principal cause.

Mr. HENWOOD: Will you tell us what was the cause?

Mr. LUKE: I will reserve giving an opinion until after Mr. Lungley, who was responsible for the launch. My duty began after the "Northumberland" stopped.

Mr. LUNGLEY: I think Mr. Henwood is so far right—at any rate, to a certain extent—that there was a rigid part at the end of the ship; that is what I call a trap. From what I gather from Mr. Henwood, he laid the slip in a certain way, and made every calculation to ensure safety, but that he made what we call a dam at the outer end of the slip to form a semi-dock, and made that part very rigid. Of course, the ship settled down on the ways; but when passing over this rigid part she could not settle down equally. There is no doubt but that unequalness was the cause. If the dam had not been there, that is, if the slip had been made in the usual and ordinary way, the part on which the ship was built being all rigid alike, the "Northumberland" would have gone off the first day as well as the last. The "Northumberland," when she did launch, launched herself. Sir John Hay will give me credit for saying at the time, "When the ship goes she must launch herself. Whatever power may be put to launch her, when the ship goes she will launch herself." The obstruction caused by this dam extended to about 6 feet in the length of ways, and formed a complete wedge on the surface, so that the ship would have, as it were, to run up hill. If we had seen this obstruction at the time, that is, the day after the ship had stopped, she would have gone the next day. There was no difficulty in launching the ship save and except this obstruction caused by the sinking of the slip before the ship came over the rigid part in way of dam, made as Mr. Henwood states. He says he drove five and three piles, and instead of making the whole equal all through, he made it unequal by the dam, and that was the trap. If he had made the slip equal it would have settled down

equally, and the ship would have gone off the first day. In laying the launching-ways, we lay it with what we call a camber, that is, arched upwards in the length of the ship about 5 inches, to allow for a settlement, so that there may be no chance of the ship settling the ways down to make a hollow line on top, and thus reduce the incline of ways. As soon as we removed the obstruction, that is, took away the part forming the wedge (I may say, I do not know if this was brought to to the notice of Mr. Luke), and as we had now overcome the difficulty, I said, now the great difficulty we shall have will be to hold the ship when we determine to launch her. Seeing that the ship was half launched, and half-way out of the slip, there would come the difficulty of the dog-shores, as we were obliged to get rid of the dog-shores about an hour and a half before high water, and as soon as the dog-shores were gone, the ship began to move. The hydraulics were of no use; no hawsers, nor any other assistance, were required. There was nothing but to hold the ship with the chains and side shores, until the tide ceased running up, and then let her go. I believe the sole reason—I speak candidly—of the ship's stopping was the unequalness of the foundation of the slip.

Sir EDWARD BELCHER: Did the tide rise as high that day as it should have risen? And did you not have a much higher tide on the day when she was launched?

Mr. LUNGLEY: That had nothing to do with it in my mind.

Sir EDWARD BELCHER: But was that the fact?

Mr. LUNGLEY: I had a great amount of trouble at the time. I do not recollect if the tide rose higher on the day she was launched or not. I do not think that would have made any difference. We had spring tides on each day when we tried to launch her, and there was not much difference. The ship lifted the next day after she stopped, and on each day of the spring sides afterwards, and we could not account for the stoppage until we discovered the hump under the way; it is now established that she was hanging on this hump.

Mr. LUKE: One or two observations I will now add. At the upper part of the ways, inside the dam or groundway, to which Mr. Henwood has alluded, there was an almost total absence of grease when we raised the bilge-ways from the sliding-planks, to re-grease; and, in my opinion, that was the principal cause of the stoppage of the "Northumberland." The grease was so squeezed out and melted, that the two surfaces of the wood came almost into a state of cohesion. This absence of grease at the upper part of the ways was, therefore, not caused by the bilgeways passing over the unyielding part referred to by Mr. Henwood. Before successfully launching the ship, we separated the two surfaces of the ways, and put in fresh grease, when we had an opportunity of seeing that the original grease was gone. From the inspection of the ways I made after the ship was launched, I believe that the cause Mr. Henwood mentioned partly contributed to the stoppage, as well as the great pressure of water against her after-body as she descended, laden with so many armour-plates, and drawing so much water. Those two causes, in my opinion, also contributed to the stoppage of the ship, but the want of grease was the principal cause.

Sir JOHN HAY: I believe there is very little for me to reply to. I am sure the additional information which has been given by Mr. Henwood, by Mr. Lungley, and by Mr. Luke, will elucidate the facts which I have endeavoured to record here. But I do not think that any of the gentlemen have mentioned that which I think Mr. Henwood, who takes to himself the credit or the blame, whichever it may be, of the general construction of the ways, has not alluded to, that it was not contemplated to launch the ship with her armour-plates on. [Mr. HENWOOD: Oh, yes.] I would merely mention that, because I believe it was not contemplated at first. The weight was very much greater than was originally contemplated. That was the information I received at the Admiralty. The first intention was to launch the ship *without* the plates. 1,700 tons more were set in motion than the Admiralty contemplated. Mr. Henwood may have looked forward to that; but the contractors did not contract to launch the ship with the plates on. Therefore, there is a certain amount of excuse, if excuse were needed, in expecting the ways to bear so much greater weight than had ever been contemplated.

Mr. HENWOOD: It was contemplated to put the whole of the armour-plating on before launching, although not *required* to do so by the contract.

Sir J. HAY: Of course, if the ways were intended to carry them, the other reason which has been stated with regard to the over-strengthening of the dam, would show where the break had been applied, and would check the way of the ship. I think we are all agreed upon that. I shall not detain the meeting further on this point, which gentlemen have explained who are more practically acquainted with the subject than I am. With regard to the peas, to which my hon. and gallant friend has referred, I certainly did not record that with any view of throwing ridicule on the proposal, nor did I mention any names. He was certainly one of the 450 who wrote to me. All the letters were replied to. I am aware that peas have great power. We all of us are aware, when the surgeon wishes to open the skull of an animal, that he fills it with peas, and immerses it in water, and the swelling power of the peas opens, in the most insidious manner, every joint in the structure. Of course, that might possibly be applied on a larger scale. But I do not think my hon. and gallant friend in his letter gave us information as to the cylindrical mode of application which he has alluded to to-day. I merely mentioned the proposal to illustrate the vast variety of suggestions that we received. I did not, perhaps, give to it the attention that it merited.

The CHAIRMAN: I am sure that you will all join me in saying that we are very much obliged to Sir John Hay for this most interesting description that he has given. We are also very much obliged to those gentlemen who have contributed to the information that has been given us on the subject, so that we have come to a pretty clear understanding of the whole subject. I quite agree with Captain Dawson as to the advisability of our having discussions on these particular points, to serve as standard information for the young executives of our service. It is a difficult thing to carry out his suggestion to print and publish all that comes under the observation or within the experience of Officers in the Service, because we must remember that that can only be done by the authority of the Admiralty. The Officer could not do it himself while he is in the service, otherwise there is a good deal of information to be got from the executives of the service upon many points analogous to the present one, or to that which Captain Dawson mentioned of getting off the "Gorgon," which would be standard information for carrying on such services under difficult circumstances. As I said before, this must be done by permission of the Admiralty, at least as long as the Officer is on full pay. We all of us unite in thanking Sir John Hay very heartily for his paper.

PHOTOGRAPHY APPLIED TO MILITARY SCIENCE.

By Lieut.-Colonel J. BAILLIE, H.M. Bengal Staff Corps.

THERE have been few adaptations of this beautiful art to military purposes, beyond that of copying, enlarging, and reducing maps and plans; but the French Exposition of 1867 brought forward some new applications, which should not be passed unnoticed, as they are calculated to be of great value to military men.

First, as applied to surveying, we have the ingenious method of surveying by photography, invented by M. Auguste Chevalier, and, as it does not appear to have been noticed in this Institution, I will briefly describe it. The method consists in taking small circular pictures, or panoramas, round each station of the triangulation into which the

survey is divided. These panoramas are printed by the ordinary photographic method, and are cut out and fastened on a sheet of drawing paper in the relative position to each other which they occupied on the ground to be surveyed; and straight lines or radii being produced from the centre of each through the objects shown in them, give by their intersections the relative position of each object on the paper, so that the "filling in," as it is technically termed, is completed as rapidly as these intersections can be found. The diagram (Fig. 1, pl. xxv) explains the process, and I need hardly point out to you the advantages it possesses over the old method of surveying with the plane-table, the prismatic compass, or even the theodolite, since it dispenses with the slow process of observing each object separately, and the liability to any possible error in recording the observation in the field-book, which is now quite dispensed with.

The camera employed is shown, in Fig. 2. It consists of a cylindrical box (which need not be larger than the prismatic compass), which contains a circular plate of glass, which is covered with the sensitized collodion film, as in the ordinary process of photography; the cover of the box revolves loosely on it, and carries the lens, which is combined with a prism, so as to produce a horizontal picture on the glass, of any object in front of the lens: as the top of the box and the lens are made to revolve round its vertical axis, a continuous picture or panorama is produced on the glass below, and of course retained by the sensitive film. The glass is removed, developed, fixed, and printed on paper by the ordinary photographic method, and the picture, as I said before, transferred to the drawing-paper in its proper position. One great advantage of this method is, that as the pictures accompany the plan, the General Officer, for whose information it is intended, has these panoramas of the country actually before his eyes, and can thus form an infinitely better idea of the ground, than can be conveyed to him by any other system of delineation, however careful or accurate; and another is that very little drawing or filling in is really necessary, as the pictures supply all the minor details, and all that is necessary, is to show the intersections of the principal objects. Of course the use of this method would be to a certain extent limited by the small size of the objects shown in the panoramas, and we must still have recourse to the ordinary method of making grand geodetical surveys, when the sides of the triangles are sometimes a hundred miles in length; but for a reconnaissance of an intended field of battle, or of a fortified position, even occupied by the enemy, this method will be invaluable. Two mounted Officers, furnished with these cameras, might gallop up from a given point, such as a tree or a bush (Fig. 5), counting the paces of their horses, and diverging from each other as they advanced, to the front of a position even within range of an enemy's guns, and take each a panoramic view and be off again before his fire could open on them; and as they would know their distance from the point from which they started, which would be also shown in both panoramas, they would bring back with them all the information necessary for a complete plan of the position and the country for miles round it: this could afterwards be plotted out in even less time than its survey

Fig. 1

A

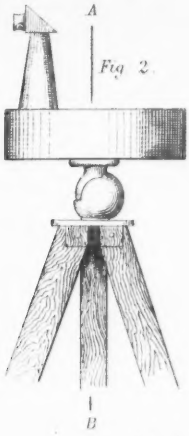
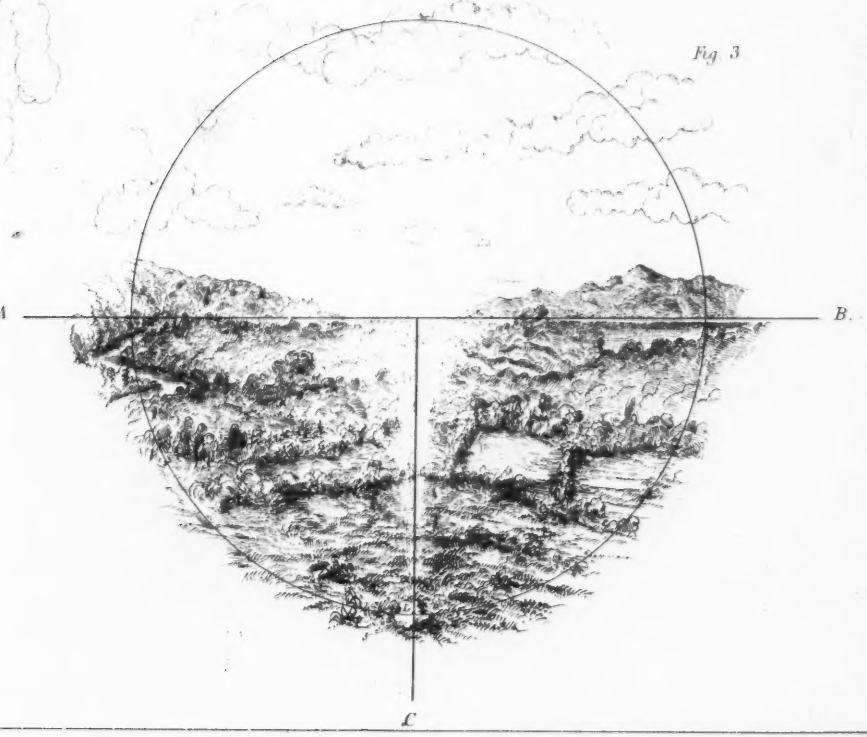


Fig 2.

Fig 3



J. Jobbins

Fig 5.

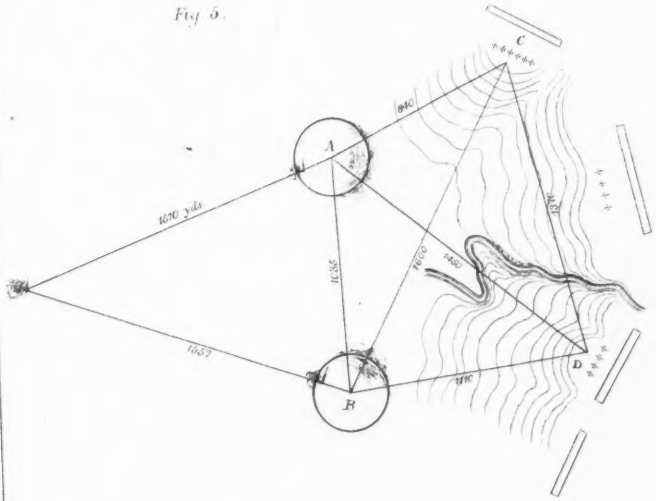
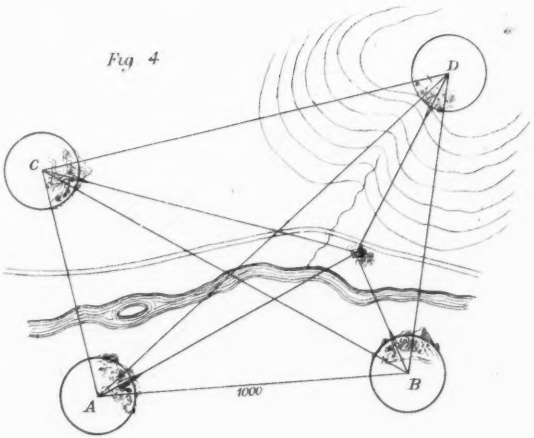


Fig 4



J. Jobbins

required. Again, by turning the instrument over on one side, so as to make the lens revolve in a vertical plane, and putting a white mark or object on the ground immediately under it, it can be used just as easily for taking altitudes and depressions for levelling, so that it is in fact a self-recording altazimuth instrument. I need hardly tell you that such an instrument is calculated to make a complete revolution in surveying, and I hope ere long to see it largely used in our Service. That it has succeeded completely, I can myself bear witness, as I saw in the Exposition a large plan of the Chateâu of Pierrefonds and the surrounding country, produced entirely by this method, and I have here a survey of the plain of Longchamps, near Paris, produced by the same means, which I have compared with plans surveyed in the old way, and I can answer for its correctness.

Photography applied to Map Drawing or Topography.

In the French Exposition there were exhibited some good specimens of photographs from relief-maps and models; among others, a map of France by M. J. L. Sanis, a copy of which is before you: the original model from which it is taken was also shown. I also obtained in Paris some photographs from models produced by M. Bardin, who devoted much time and labour to topography, and who, I regret to see, is recently dead. His process of modelling was one that I had the honour of suggesting in a lecture at this Institution some years ago. After making a careful survey and contoured plan of the ground to be modelled, he traced out each contour on a sheet of cardboard, and having cut it out carefully, he built each contour up in its proper position, so as to produce a solid model. From this he took moulds in plaster of Paris, and from these, casts in the same material, and from these again he took photographs, some of which I have here, and which are very beautiful. If you close one eye, and look at them you will be surprised to see the wonderful illusion of solidity and relief that they afford. You will observe that some of these photographs show the edges of the cardboard, so as to give each separate contour, while others have only the smooth rounded surface; he obtained this very simply, by dusting over his casts with fine impalpable powder, so as to fill up the steps, as it were, between each contour, and reproduce the actual slopes of the ground. The other maps I have here are by Raaz, of Berlin, produced by photo-lithography from models. This, of Palestine, gives the effect of relief very beautifully. All these maps are produced from actual models, previously prepared from surveys, except perhaps this, of Asia, where a good deal of the central portion in Thibet and Chinese Tartary has, perhaps, never even been visited by a European, and must be considered to be "evolved" from the imagination of Humboldt; it may not however be less valuable on that account. However, it is not so much the maps, as the process of producing them, to which I wish to draw your attention, and it seems to me that we have here a method of producing maps and plans by the aid of photography, which will supersede in rapidity of execution all

the elaborate systems of "hill drawing" and "scales of shade" upon which military engineers have lately been spending a large amount of time and discussion, with, I fear, very little useful or practical result. The great end and aim of all topographical drawing must be, in my opinion, to produce to the eye, as nearly as possible, what we may conceive to be the actual appearance of the surface of the earth as seen from a considerable distance above it; but a certain amount of conventional drawing must always be introduced into these representations, because we require from a map more information than the earth's surface would give us, even if we could view it in this way. Setting aside the names of places, which could only be seen, perhaps, near some of the railway stations, we should scarcely be able to make out the outlines of the great continents and islands into which our globe is divided by the ocean, because water is very little less transparent than air, and at great distances—such as that of the moon from the earth—we really see through the ocean to the deepest recesses of its bed, and the only evidence of its existence on the earth's surface would be a slight deepening of the tint of the earth, like that produced by looking at an object through a thick pane of glass. Rivers, in the same way, which are merely the intersection of two opposite planes of watershed or drainage would also be invisible. Mountains, again, would only be visible when their ridges and ranges were brightly illuminated on one side, while the other was left in deep shade; and this you may observe for yourselves by examining the moon's surface in its different phases with a telescope. When the light falls directly on its surface at full moon, the mountain ranges are scarcely traceable, though, with an oblique light, they come out with great beauty, as you may see in some of Delarue's photographs and Naysmith's drawings of the remarkable volcanic craters on it. Still, a photograph of any relief or solid will always give us a much better idea of it than any drawing, however carefully it may be made, because it reproduces the illusion of actual solidity and relief, and requires no previous education of the eye to enable us to appreciate it: and for the same reason a photograph of a statue, or a bas-relief, or a building, will always be preferred to the most elaborate drawing of it an artist or an architect can produce. Now, I think photography can do for us in topography quite as much as it has done for sculpture and architecture, and I propose that, in future, when we want a map or plan properly shaded, we should reverse the usual process, and model it first in wet sand from our survey, and photograph it afterwards.

Mr. Galton, in a paper read before the Royal Geographical Society, and published in the thirty-fifth volume of its Journal, has shown how easily this can be done from ordinary models in plaster of Paris, and other materials, and there could be no difficulty in doing the same thing in the field from the sand model. A cart-load or two of sand, and a tripod scaffolding, built up of scaling-ladders to carry the camera, would be all that we need, and there are some excellent modellers already in the Royal Engineers, as the Museum of this Institution can bear witness. The construction of the model may be

greatly expedited in practice by simple mechanical expedients: for instance, buildings may be represented by pieces of cork simply laid on the sand in their proper positions; walls and fences by slips of cork or cardboard inserted in the sand; hedges by similar slips edged with a little moss glued to them; trees and bushes by lumps of moss, or Berlin wool pulled out; the rails on a railway by slips of blackened cardboard; telegraph lines by needles, with a fine thread run through them and stretched, and lines of sections, &c., by threads stretched across the model; ditches and roads and railway cuttings may be scooped out by slips of tin bent to the required section, and even the furrows in fields may be shown by slips of tin, with saw edges at different intervals, so as to show the varying natures of the crops. Numerous similar expedients will readily occur to an expert modeller, to be applied as the nature of the country and the scale of the model may demand. The same process would be applicable to plans of fortification and other military works, both of attack and defence. There is no reason, too, why the same process should not be adopted in our ordnance survey. The hill drawing of some of the earlier sheets of this, on the one-inch scale, is very poor, no better than might be expected from their date, when the art was in what we might style the early "caterpillar" period, and they should be redrawn on the six-inch or twenty-five inch scale, and reduced by photo-lithography, and transferred to stone at once. Steel and copper-plate engraving is too slow a process in the present day, and even with the aid of the electrotype process of multiplying duplicate plates, these soon deteriorate, while we have to wait years for a single sheet, as in the Indian trigonometrical survey. By substituting photo-lithography from the model, we can dispense with both the draughtsman and the engraver, and we should obviate all difficulties as to scales of shade; whilst by printing our maps in different colours we should be able to give much more information in them without confusion, and they would be greatly improved in appearance.

Photography in the Field and under Fire.

I have shown in the first part of this paper how it is possible to make a survey of an enemy's position, even under fire, by the aid of photography; but this plan involves certain conditions, which can only rarely be secured. It could not be carried out, for instance, if the enemy covered his line with advanced videttes of Cavalry or picquets of Infantry, as he ought to do, when not liable to momentary attack, so that, to obtain a photograph of his works it might be necessary that the videttes and picquets should be driven in, which we could generally do with an inferior force, or sufficiently so to enable us to get a good view of his lines. The photographic party must accompany our skirmishers, and get well in front, so as to have a good view; it therefore becomes a question as to what kind of camera could be used for the purpose. The grand photographic van that was constructed for the Crimea, a kind of hybrid affair, between an ambulance and a bathing-

machine, would be manifestly useless. And even if we left this in rear, there is still the camera and its stand and supply of plates to be carried, and it ought to be able to accompany the Artillery. I have therefore come to the conclusion that we cannot find a better model for the apparatus than a light galloper-gun and limber, with a well-trained squad of real gunners to take the photographs. A gun-carriage is as firm and portable a stand for a camera or anything else as we can possibly produce, and the elevating screw would enable us to point it as quickly as a gun. The limber-boxes would contain any number of charges of prepared plates, each in a separate box, and, with cool, steady fellows like our Artillerymen, the camera could take a picture for every shot from the gun beside it. I would go further and make the camera as nearly like an Armstrong gun in appearance as I could, so that it might take up its position with the guns, say on their windward flank, so as to be taken for one of them, and thereby attract less attention. It may seem puerile to some of you to propose a photographic gun-drill, but there is a considerable similarity in the processes and also in the principle involved, which is simply the division of labour; and there is nothing really more ridiculous in drilling men to take photographs than in drilling them to cram powder and shot into a tube as quick as they possibly can, and apply a light to it. We do not, in ordinary shooting at birds or hares, go through all the motions of the manual and platoon exercise, but if we want to fire twenty rounds in a minute, or to get 1,000 men to fire a volley together, we know that the manual and platoon is the best and the only mode by which we can effect it. I feel quite sure that it is very much easier to teach Artillerymen the mechanical processes of photography than to give the photographers the nerve and coolness under fire that our Artillerymen possess. And, after all, the only non-mechanical part of the photographic process is the focussing and timing the exposure, and the last is simplified by using one of the instantaneous processes. These photographs need not be again printed on paper, unless it were desirable to retain copies of them for record. On the contrary, it would be sufficient to use what is called a positive process, which, when backed by black varnish, gives a picture distinct enough for all ordinary purposes. The process must be simple and inexpensive, as it is extensively used in the east end of London in establishments where you are offered "a clean shave and your portrait for threepence." A Commander-in-Chief having several of these cameras at his disposition, would literally have his eyes everywhere. He could be supplied with these optical reports from each division of his Army as fast as orderlies could carry them, and I believe it would be possible for him to remedy with them the defects of his own short-sightedness. I have said the camera should be constructed to imitate a gun, and I believe it is quite possible to convert the long tube into a telescope, and so to obtain pictures at a range quite equal to that of the gun itself. I must leave it to photographers to say how far the loss of light in a greatly enlarged picture might weaken its impression on the sensitive plate, but I have no doubt they could easily supply us a "process" suited to the purpose, and, in the meantime, we may recol-

lect, that any photograph, carefully focussed, will bear very considerable enlargement in the magic lantern, and the details even of the extreme distance, will be faithfully reproduced, though so small as only to be visible with the microscope.

I fear your patience must be nearly exhausted with this prolific subject of photography, but there is still another application of it which I do not like to leave unnoticed, because it is one that may be specially useful to yourselves; that is, photography as a substitute for printing or lithography. You have all, I daresay, felt the want of a simple printing or lithographic press by which you could yourselves produce twenty or thirty copies of a circular, a programme, a bill of fare, your latest poetical effusion, if you are given to poetry, and fifty other things of the same kind. The same want is felt in the Army, whether in the field or in quarters. There is every day a crop of orders and memos to be written and copied, and published by or to each individual in it. We begin in the morning with general or division orders, and these are filtered down all day through brigade and regimental and company orders, and through various ramifications in memos to Adjutants and Quartermasters, and Surgeons and Commissariat Officers, and *id genus omne;* all more or less require to be copied; consequently in the field a large proportion of the camp followers are the clerks, whose special duty it is to perform this copying and distributing process. In the field this is specially objectionable, for these clerks are sometimes leaky vessels, and mistakes happen—important information miscarries. In India this has frequently happened, and I recollect, in the first Sikh campaign, a native writer in one of the head-quarter offices was detected in one of these mistakes, and quietly sent home, instead of being hanged. However, such is the system, and bad enough it is, for want of a simple copying-press.

Now photography again steps in to supply this want, and I think if you try the plan you will find it does so efficiently. Take a common frame with a glass in it, like the transparent slates that children use for tracing on, but with a bit of polished glass, though the ground glass would do on emergency; daub this well over with a mixture of wax and lampblack till you cannot see light through the glass. Then with a needle fixed in a light handle write your letter, or make your sketch on the glass, taking care to remove the wax clear and clean at each stroke. Now slip into the frame a bit of paper, prepared in the ordinary way for printing photographs, by soaking first in the salt and water and then in dilute nitrate of silver,* and replacing the back, put the frame out in the sun for a few minutes; then take out the paper, dip it in a solution of hyposulphite of soda,† to fix it, and wash and dry it. The process takes longer to write than it does to put in practice, and though nitrate of silver and hyposulphite solutions have a fine chemical tone about them, they are not a bit more difficult to use than the solution of sulphate of iron and nut-galls, which composes common writing-ink. A Staff Officer might take a dozen of

* Nitrate of silver 60 grains to 1 ounce distilled water.
† Hyposulphite of soda 6 ounces to 30 ounces of water.

these frames in a box beside him; and they may be printed by a man or boy who cannot read. The paper, of course, must be prepared at night, or in a dark room or tent, and should be kept in the dark till used. There is nothing very novel or original in this copying process; it is simply a combination of the old classic method of writing on wax tablets with a style, with photography, and it is the converse of the first step in photography by which some fifty years ago copies of lace, feathers, leaves, &c., were printed by it. The only objection to it is, that we cannot print on both sides of the paper, but this I think is common to all copying processes that I am acquainted with. By leaving out the lamp-black in the wax ground and using a thicker coat of wax, only, say one-eighth to one-quarter of an inch, a clever draughtsman can produce very beautiful pictures by this process with great rapidity. The greater or less thickness of the layer of wax left on the plate produces in printing very soft and delicate gradations of light and shade, similar in effect to the Berlin porcelain picture screens. This leads me to another application of this process of printing, which I may mention here, though it is not strictly a military one. Many of you are probably aware of the difficulty of representing certain statistical facts and details pictorially. For instance, suppose you desired to represent on a map of England or of London the density of population, or in an educational return the number of persons who cannot read and write, which I may call the density of ignorance over a given area; or in meteorology, the annual rain-fall; or in hydrography, the varying depth of water in a channel; or, indeed, for any other purpose where a graduated tint is to be produced, the only method I know of hitherto is a system of cross-hatching by ruled lines, the accuracy of which must depend entirely on the skill of the engraver you employ. This process enables you to produce the required result yourself in a purely mechanical way, by simply scraping away the wax so as to leave a very thin coating only, where the greatest depth of tint is required, and I believe there is no other mode of printing that will do it so accurately or rapidly, and I think it might be adopted with advantage by the Registrar-General, and for many of our Parliamentary returns and reports.

I will return for a few minutes to its application as a substitute for printing. It is not necessary that copies should always be produced from the tablets on paper in order to make them public; they can be read at once by holding them up before the light, and if we wish to publish them to fifty, or a hundred, or a hundred thousand persons at a time, we could do it just as easily by putting them into a magic lantern, which is only a camera-obscura inverted, and exhibiting them on a large screen of cloth, or a blind in a window, or on a whitewashed wall or other large white surface, so that "he may read who runs," if he can. It would not be always desirable to publish our orders to the whole Army at once in this way, but it might be useful sometimes to issue a proclamation or notification to a great number of persons, and with one of Captain Bolton's signal lamps it would be quite practicable not only to enlarge the writing sufficiently for this purpose but to throw the image to a very considerable distance, and there are

many cases where signals and messages could be conveyed more rapidly at night by this means than by the process of spelling out each word by a combination of flashes. One use of it occurs to me at once, that of showing the names of our lighthouses along the coast at intervals, so as to prevent the fatal accidents that frequently occur from their being mistaken. Another might be conveying instructions to ships coming into harbour, or even manœuvring at sea. But I am already wandering far away from photography, I will therefore conclude, trusting that I have said enough to show you that military science, like any other branch of science and art, will benefit very largely by the assistance of the wonderful and beautiful art of photography.

The CHAIRMAN: Would any gentleman like to ask any question upon the subject?

Sir WILLIAM CODRINGTON: The difficulty with regard to issuing orders in an army I fancy arises from having to carry the type. Therefore, if this means of scratching away wax on a plate and exposing it to the light should be available, of course it would prevent that necessity. Does it require the sun to make the impression from that?

Colonel BAILLIE: No; only a strong light.

Sir W. CODRINGTON: The paper must be freshly sensitized, or is there any difficulty in carrying it so sensitized?

Colonel BAILLIE: The paper can be kept about a week. Beyond that period it is rather apt to deteriorate. It is desirable that it should be prepared every night.

Sir W. CODRINGTON: Are the stores for wetting it and preparing it simple?

Colonel BAILLIE: Extremely simple. Nothing more than a solution of common salt and distilled water is the first process. On that the sensitive solution is applied, ammonia and nitrate of silver. I have not entered into the details, because Mr. Pritchard,* in a lecture delivered in this Institution about ten days ago, entered into the whole process, and he explained it so satisfactorily that I do not think it necessary to add any more upon the mere technical process of photography.

Sir W. CODRINGTON: As I understand, no printing is actually required?

Colonel BAILLIE: No printing from type.

Sir W. CODRINGTON: And no printing from what is called the carbon-process?

Colonel BAILLIE: Nothing. Simply the light passing through the glass leaves the picture.

Sir W. CODRINGTON: For each order you would require a plate to be exposed, then how long would it take to give 100 orders? that is the point.

Colonel BAILLIE: Photographic printing of that kind is really now instantaneous. The moment the sun's light touches it, the print is there. It takes a little time to develope afterwards, when it is put into the solution; but it is instantaneous to all intents and purposes.

Sir W. CODRINGTON: Then there is the solution besides?

Colonel BAILLIE: That is to remove the nitrate of silver afterwards, to prevent the picture fading. After the picture is taken out of the frame it is thrown into a large basin of hyposulphite of soda solution, which is the washing process, as it is called. It is allowed to soak there for twenty minutes or half an hour, to prevent its fading. But that would not be necessary with this process, because the orders are not supposed to be kept longer than a day or two.

Colonel HUME: If any orders were required at night, you would have to use a strong light?

Colonel BAILLIE: Yes; the magnesium light would do.

Colonel ALCOCK: Would Colonel Baillie explain the process of taking a panoramic view?

Colonel BAILLIE: The glass is placed in the bottom of the instrument. It takes

* See "Journal," vol. xiii. p. 419.

the place of the compass card in our surveying compass—the instrument is very much in that style. The glass is previously prepared by any sensitive process; what we call the dry-plate process, which takes a picture almost instantaneously, is perhaps best suited for it.

Colonel ALCOCK: Does it take the whole circle?

Colonel BAILLIE: The whole circle, as fast as you can pass it round. We have processes now in photography which will take objects instantaneously. We had pictures exhibited here the other day of birds on the wing.

Colonel ALCOCK: How much of the circle is taken at one time?

Colonel BAILLIE: Only the portion immediately under the prism is taken at one moment, but we take the whole circle, because it is not worth while to take portions of the circle. Where you have the plate sensitive all over, it is better to take the whole circle at once. Fig. 1 represents a sketch of the panorama after it is produced, when it is taken out and printed on the paper. Supposing this (pointing) to be the centre of the picture, the panorama is represented all round the circle. The circle represents the horizon line, and by drawing lines from the centre through the horizon line to any object, a steeple here, the top of a hill there, the corner of a house there, we have the whole of the angles all round the station. These are panoramas (Fig 4) A, B, C, D, cut out and pasted down on the paper. Of course it would be necessary to measure one side, such as A, B, for you are aware we must have a base in any survey to give us a scale, and from that, as I said, we might produce the whole of the survey. Two Officers take up their position in front of a position (Fig. 5). They take one point such as the tree, so as to complete the triangle; then, with their distances from the tree they are able to calculate their distance from each other, which is the base, A B. Having secured their panorama at each end of it, on their return they are able to calculate the separate distances, A D, C B, and C D, from this. This figure (Fig 3) shows the application of the instrument to taking vertical angles. In this case the instrument is turned down on one side on its ball and socket joint. The box becomes vertical and the tube horizontal. Then, as it is turned over, the whole of this picture (Fig. 3) would be taken instead of that one (Fig. 1). For instance, here would be the horizon, A, B. Then, as the instrument travels downwards to C, this (D) would represent the station, or any white object placed underneath the box as a mark. Again, as we travel round, we show the elevation of another portion of the horizon, B. Then, as we pass on, we come to the clouds above, which are shown as they would be seen directly from underneath. Again, we come to the sun, or any other object sufficiently powerful to print itself, the moon even, and we should have its actual altitude above the horizon from this point.

Sir W. CODRINGTON: I do not quite understand. If this instrument is placed, say at A in Fig. 4, it reflects what is seen in front. How does it take a plan?

Colonel BAILLIE: It takes bearings of objects all round the circle, just like the compass or theodolite. A represents a station of the Officer or observer.

Sir W. CODRINGTON: Still only what is seen before him is represented?

Colonel BAILLIE: What is seen before him and round him as the top is moved round. The centre of the picture will be left entirely blank.

Colonel YORKE: M. Chevallier's instrument revolves, does it not?

Colonel BAILLIE: Yes, it revolves. The top of the box is not shown in this figure (Fig. 2), but it revolves round the circle, round the vertical axis of the instrument, A B.

The CHAIRMAN: It revolves round over the sensitive plate?

Colonel BAILLIE: Yes; it revolves round over the sensitive plate.

Colonel YORKE: Under the vertical part of the camera there is a slit?

Colonel BAILLIE: Yes, a narrow slit or diaphragm, to confine the action of the light.

Colonel YORKE: The upper plate which carries the tube revolves round the lower plate, and you thus get an annular picture.

Colonel BAILLIE: Precisely.

Colonel YORKE: M. Chevallier speaks, I think, of a clockwork motion?

Colonel BAILLIE: Yes; he adapted a complicated clockwork motion to it, but it

is not necessary to its action. He was not acquainted with any instantaneous process. This instrument was invented in 1859, but it was only brought forward at the Exposition of 1867. At that time he does not appear to have been acquainted with any sufficiently instantaneous process. In fact, there are not many that can be actually practised in England. In France they have a better climate and a clearer sky. There was one invented some years ago by Mr. Skaife; he produced what he called a pistol-graph. That was sufficient, where you have anything like a bright sun. In India I have taken with it a horse in motion, and a man lifting up his arm. You see the arm instantaneously arrested. I have not practised photography much in England, and it requires favourable conditions of the sky here to take instantaneous pictures, but although I show the full details here, you are not to suppose that the picture, as taken on that card, would be anything like the photographs that were exhibited here the other day. All we want is a simple outline, and a few distinct points, sufficient to show the prominent objects of our panorama. In the same way we can show the direction of the magnetic meridian. We should put a pocket compass on the box and send out a man to any point in the proper direction near the horizon to hold up a white staff; and when the picture was taken he would be represented in it with the staff, and that staff would be the exact direction of the magnetic meridian. The picture is thrown down by the combination of a prism and lenses to convert the rays from the horizontal to the vertical direction. I regret that I have not got the instrument to show you. I very much doubt whether it has been introduced into this country. When I was in Paris I tried to get one, but they had not commenced to manufacture them. The only one I saw was the one made by M. Chevallier, and exhibited with the plans. Those were exhibited with the actual photographs upon them, so that there can be no question about the practicability of the method.

The CHAIRMAN: The meeting will, I am sure, join me in thanking Colonel Baillie for the information he has given us. It is evidently the beginning of a subject that may be of great use hereafter. I leave military men to judge of that; they will know more about it than we sailors can do. But it is evident there is the foundation for a great deal of use in it.

Evening Meeting.

Monday, June 7th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 31st May and 7th of June, 1869.

LIFE.

Kerr, Lord Walter Talbot, Comm. R.N. 9*l.*

ANNUAL.

Baring, E., Lieut. R.A. 1*l.*
Maurice, J. F., Lieut. R.A. 1*l.*
Carmichael, L. M., Lieut. 5th Lancers. 1*l.*
Colvill, Charles, Lieut. 54th Regt. 1*l.*
May, Charles H., Capt. R.N. 1*l.*
Brownlow, A., Commr. R.N. 1*l.*
Berkeley, F. G., Capt. 47th Regt. 1*l.*
Brown, F. D. M. C.E., Capt. Bengal Staff Corps. 1*l.*

THE REVOLVING SYSTEM OF FIRING GREAT GUNS.

By Commander BENJAMIN SHARPE, R.N.

BEFORE describing *revolving guns*, it may be desirable to glance at some of the present requirements of naval warfare, arising from the gradual increase in the size of the guns employed by different nations, in order that the very serious position in which so many of our best Officers consider our iron-clad fleet to be at present placed, may be brought prominently forward, and the remedy proposed be better appreciated.

In our old and glorious wars, battles were fought and ships were taken without the aid of plating (one of the principal of modern requirements), it being unnecessary, as the vessel's safety was seldom compromised by the shot then employed; for, with the exception of the "Glatton's" 68-pounder carronnades, 32-pounders of 56 cwt. were the largest guns in use, and these were confined to the lower decks of ships of the line, a 24-pounder frigate being considered a heavy frigate. With the introduction, however, of more powerful guns, throwing shot of greater diameters, the very existence of the vessel came into question, as shot holes, from eight to thirteen inches in diameter, will rapidly admit a highly dangerous stream of water, and which during an action would be difficult, if not impossible to exclude. Hence arose the necessity for

armour-plating, a necessity in reality confined to those parts of the vessel where the entrance of shot will be followed by water; and had the employment of armour-plating been strictly limited to these parts, instead of being diffused over so wide an area, that a thickness of only 4½ or 5½ inches could be employed, the country would have been spared the useless expenditure of millions on our present fleet of iron-clads, which are merely weighted, but not protected by plating so slight, and which, in the event of a war, will leave them at the mercy of any properly-armed gun-boats; these ships are, indeed, in a worse position than wooden vessels, as shells, after passing through one of their sides, will be retained inboard and explode.

Unfortunately for the country, the temptation to carry the plating sufficiently high to include the guns and their crews, was too great to be resisted, and a serious reduction of the proper thickness of the plating was the necessary consequence. The general weight of the armament had also to be greatly reduced, and the size of the vessel considerably increased: this applies equally to the broadside, turret, and box systems.

As the vessels of our fleet can only support a given weight of plating (barely sufficient for the protection of their wind and water lines), it necessarily follows, that every ton of plating devoted to the exclusive protection of the guns and their crews, as for instance, all that above the deck-beams in the broadside vessel, and on the turrets and boxes, in turret and box-vessels, is so much taken from the security of those vessels. The mistake, indeed, is of a two-fold character, for if 4½ inches of plating is insufficient to keep shot from penetrating the water-line, it will equally be incapable of protecting the guns and their crews; but wherever there are ports, the value of any plating becomes greatly reduced, for besides shot and shell entering them, ports can always be commanded by grape and canister from a few light guns, or by musketry, while the water-line (the true point of attack) is being invaded by both ram and guns.

I am not drawing an imaginary picture. To show the extent of the evil, I hold in my hand descriptive drawings of thirty of our iron-clads, and out of these thirty vessels, no less than twenty-five of them have only a thickness of 4½ inches of plating to prevent shot from sinking them; four have 5½ inches, and one only has 6 inches, all entirely owing to the plating being employed in the protection of the topsides, turrets, and boxes.

The greater part of my audience, from their professional experience, must be aware that such plating can be penetrated without the slightest difficulty, but the general public do not possess the same technical knowledge, or there would be a wide-spread feeling of alarm and dismay at the very serious position in which our fleet is now placed. The impression is, on the contrary, general, that the many millions which have been expended on some of the most singular vessels this world has ever seen, have at least provided these vessels with a metallic covering capable of keeping out shot and shell; but the sooner the fallacy of this is generally known, the better, as we may be caught totally unprepared.

I will, with your permission, read what Mr. Watts, our late Chief Constructor, and Admirals Sir Thomas Hastings and Sir Robert Smart say on the subject, and these are names which will bear the greatest professional weight with the country. I am anxious to do so, as they allude in such favourable terms to the revolving system of fighting great guns, which I am about to bring under your notice, and which I trust will aid us in our present difficulty.

TESTIMONIALS IN FAVOUR OF COMMANDER SHARPE'S REVOLVING GUNS.

From Mr. I. WATTS, *late Chief Constructor of the Navy.*

6, Howley-place, Paddington,
October 20, 1868.

My dear Sharpe,

After further consideration of your plan, I have no wish to withdraw what I have said regarding it, or to restrict you in mentioning it to any of your friends if you think it worth while to do so. I have endeavoured as the most friendly act to see what objection I could raise, and can find none.

As regards its application, it appears to me to be admirably adapted for gun-boats. Small vessels comparatively, might carry 4 (say) 7-in. Whitworth guns, capable of penetrating the armour-plating of most of our present ships—if not all.

I have been sketching in a very rough way my notion as to how these guns might be placed, and the character of the vessel, you can, no doubt, make a perfect design if you think fit.

The midship section to be somewhat of the form I have sketched with considerable tumble—home, and admitting in consequence of the armour-plating being considerably reduced in thickness.

A belt of armour about five feet, two and a-half feet above, and two and a-half feet below water, would, I think, be sufficient; above that you might have turn-down bulwarks quite light.

Double or single screws as might be desired.

I think I have given sufficient to indicate the current of my thoughts.

The plan—an unobjectionable one—of devising the smallest gun-boat or vessel, would be regarded of great value, and I do not think you could put forth yours in a more striking manner.

(Signed) I. WATTS.

From ADMIRAL SIR THOMAS HASTINGS, K.C.B., *head of the Naval Gunnery Department and Ordnance for many years.*

7, Seymour-street, W.,
October 23rd, 1868.

My dear Sharpe,

I thank you for the trouble you have been so good as to take in calling on me, for the purpose of explaining your plan for using revolving guns. The proposal is new and daring, I have never seen anything like it, and having thought on it for twenty-four hours, I cannot find out any point to object to, and I shall perhaps sum up my cogitations best by telling you, that had I the power to do so, I would at once order a gun-vessel with a velocity of at least twelve knots an hour to be constructed; in such a vessel an enterprising man might astonish the world by his deeds in war.

I am convinced that it is of the last importance for the maintenance of our superiority at sea, and for the protection of our trade, that we should have a numerous heavily armed flotilla, the first division having the highest velocity which could be given to them, the second and third, perhaps of smaller dimensions and a lessened velocity, corresponding to their diminished tonnage.

All our present style of gun-boats are below the mark, and will be swept away.

The sort of vessel I have pointed out would be indispensable in a war on the Black Sea and the Baltic, and most valuable in the Channel.

Believe me it has given me much pleasure to see an old "Excellent" exercising his talents for the good of the Naval Service, in which I have often lamented that you had not received the reward your zeal and ability deserved.

(Signed) THOMAS HASTINGS.

From ADMIRAL SIR ROBERT SMART, K.C.B., K.H., *late Commander-in-Chief in the Mediterranean.*

Chiswick, February 22, 1869.

My dear Sharpe,

I have received your note, and think myself lucky that I left my gold-headed cane behind me, since it produced your note.

I am glad indeed to have seen your further development of your plan of working heavy guns with a vertical and horizontal motion, and where the guns and men are for the most part under the fighting deck, protected by the increased thickness of plating of the ship's sides, which if thought necessary may be added in proportion to the weight dispensed with from the absence of turrets.

Having seen the remarks on your scheme of arrangement, made by Mr. Watts, late of the shipwright department of the Admiralty, I concur fully in their justness, and believe that for vessels of a moderate depth of hold and speed (a desideratum in our service), your arrangement which would arm them heavily would be all important, and should be tried.

Such ships so armed would be "uncanny" customers for your leviathian armour-clads, if you can thoroughly control the recoil in the first place, and keep the water out in the second, which are heavy and important details.

(Signed) ROBERT SMART.

Mr. Watts, the late Chief Constructor of the Navy and the author of so many magnificent ships, gives, as his opinion, that a 7-inch Whitworth gun carried by a comparatively small vessel, is capable of penetrating the armour-plating of most of our present ships, *if not of all.* Admiral Sir Robert Smart, whose practical experience no one will gainsay, concurs fully in the justness of his remarks, and Admiral Sir Thomas Hastings, one of our highest authorities on these subjects, considers that all our present gun-boats are below the mark, and will be swept away.

Experiments at Shoeburyness on the 4th June (since these remarks were penned) have shown that a 5-inch plate can be perforated by a shot from a 7-inch muzzle-loader Woolwich gun with only 8 lbs. of powder (a less charge by 2 lbs. 11 ozs. than that of the old 32-pounder), the shot passing completely through the plate (rolled some months since by Sir John Brown and Co.).

This is not a satisfactory position for the country, and for our Officers and men, who, if a war were to break out to-morrow, would be placed in the same false position that they were in, in the American War: the same sad lesson bids fair to be repeated.

But a remedy is fortunately open to us. We can by stripping off the plating from the topsides, turrets, and boxes, at once increase the substance of the plating on the wind and water portion of the vessel,

and obtain the desired security against being sunk by shot; to resist the ram we must adopt other means, a description of which will be foreign to this paper. By this act we of course deprive the guns and their crews of the special protection they now enjoy. A shot which passes through a topside, turret, or box, however, is not attended with the same perilous results as one passing through the water-line, and the guns and their crews will be in as safe a position as that which satisfied Nelson and our great war captains, indeed far safer, for instead of the iron hail of Trafalgar, the shot will be few and far between, from the guns carried being so greatly reduced in number, and the increased size of the guns will not entail any greater risk to individual life, as a 6-pounder will as effectually kill a man as will a 600-pounder.

So little, however, does the superior claim of the water-line appear to be regarded, that both the "Monarch" and "Captain," two of our latest constructions, have ten inches of iron, besides an inch and a half of iron-skin on their turrets, while their sides are only defended by eight inches; but no sane Officer would think of attacking 11½ inches of iron when eight inches offered greater facilities and a more decisive result. These two vessels have each some 500 tons of dead weight, in the shape of turrets, exclusively devoted to the protection of four guns, which weight in no way contributes to the safety of the vessel. But assuming this latter to be sufficiently provided for, it is a fair question to ask, whether the "Monarch" and "Captain" would not be infinitely more formidable if the 500 tons of turrets were turned into additional guns, and employed as active, instead of passive agents?

If we turn to our Naval records there will be ample evidence of the extreme danger to which a line-of-battle ship was exposed when becalmed within reach of gun-boats.

What then will be the fate of the "Monarch" and "Captain" with (instead of 70 or 80 guns) so very few guns, if attacked only by a number of screw colliers, each armed with a gun capable of penetrating their water-lines? They would be helpless,—more particularly if a herring-net, or a piece of a boat's fall got round their screws.

On one point there can be no question; viz., that the "Monarch" and "Captain" are built some 500 tons or more larger than they need otherwise have been, not for working four guns (as the rotary platforms might still be retained), but for affording these guns an imperfect protection 500 per cent. heavier than themselves.

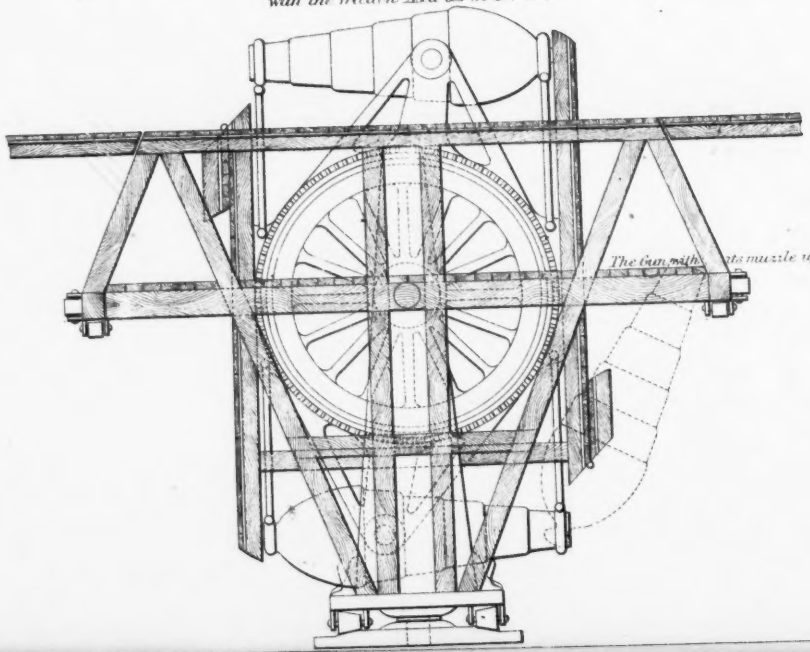
As a drawing of the "Royal Sovereign" in the *Illustrated London News* more particularly drew my attention to the serious evils of the present system, I cannot do better than take this vessel to illustrate my remarks, as she combines both the past and the present, the object attempted, and the cause of its failure.

As a wooden three-decker the vessel was thoroughly seaworthy, and mounted some 400 tons of ordnance; but since her conversion into a turret-ship, she has become unsuited for sea service, and as the 5½ inches of plating on her sides can be easily penetrated by shot and shell, she is just as liable to be sunk as before.

But what, may we ask, has occasioned such a failure? for when a

N° 1

with the friction Axle as in N° 5.



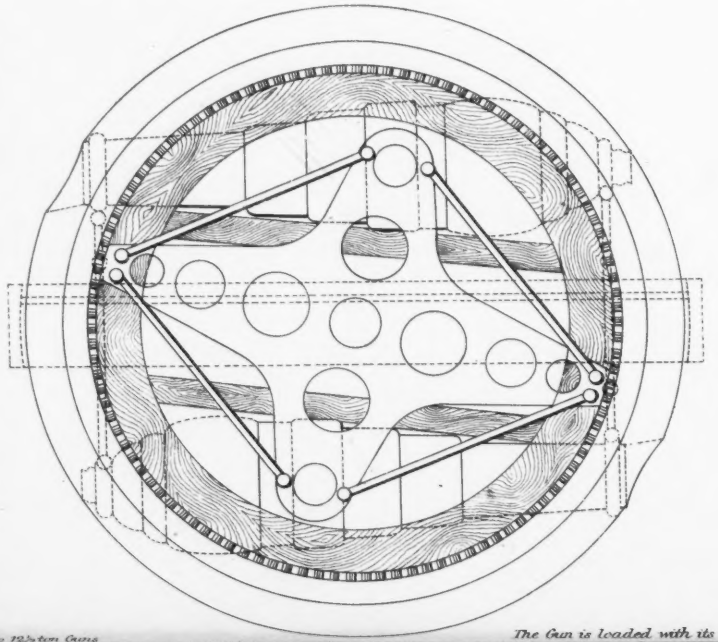
Two 25 ton Cranes

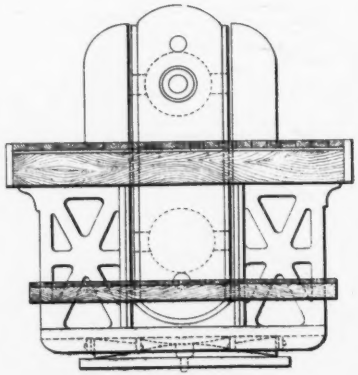
J. Tobbins

Five 25 ton Cars

obbins

N° 3.





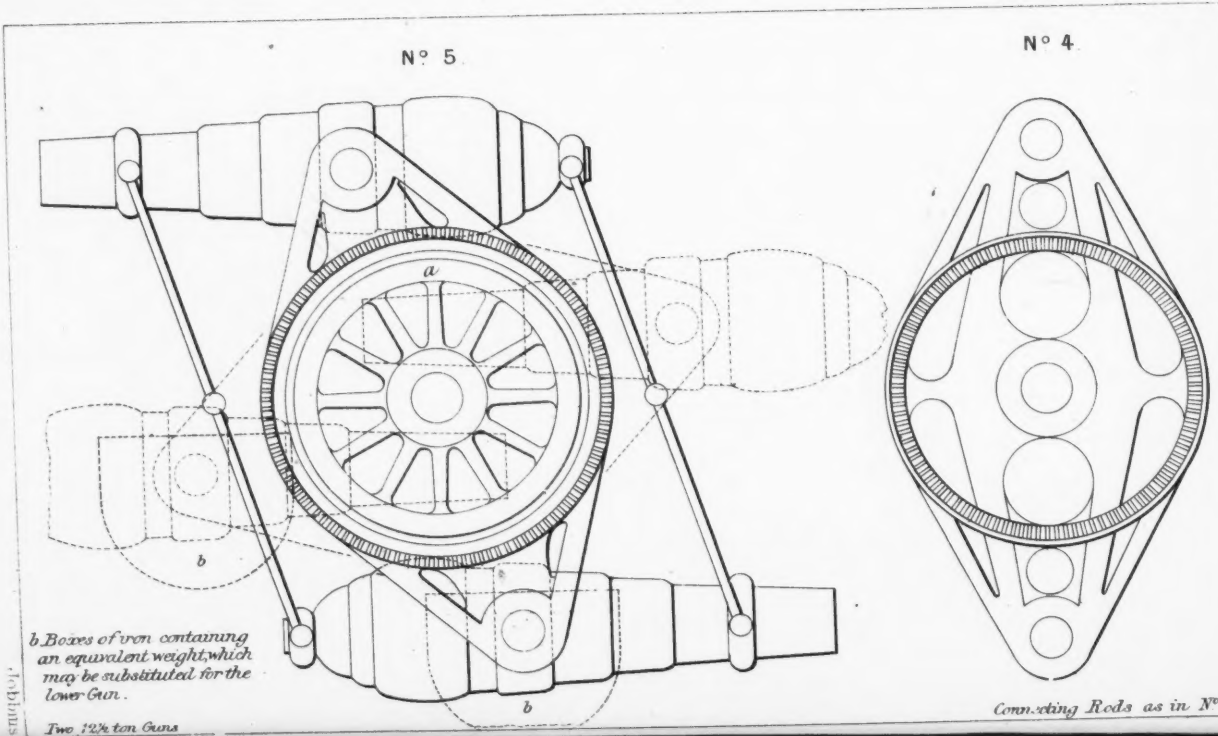
An end-on view of the same on half the Scale.

The Gun is loaded with its muzzle up.

The Gun is loaded with its muzzle up

Two 12½ Gun

obbins


N° 5
N° 4
a
b
b
b
b Boxes of iron containing an equivalent weight, which may be substituted for the lower Gun.
Two 12¼ ton Guns
Connecting Rods as in N° 5

lower Gun.
Two 12¼ ton Guns
b
Connecting Rods as in N° 5
XXX

vessel has been relieved of so great a weight of ordnance, of decks, masts, yards, and topsides, a different result might have been anticipated.

It is simply this, the four turrets weigh 611 tons, and this enormous weight of metal has been diverted from where it would have insured the vessel's safety, to the infinitely less important object of *protecting* five guns in four turrets, and has left her in her present helpless position with only 5½ inches of plating, and without canvas to aid her should her screw become damaged.

Until a vessel has been secured from foundering, every ton of defensive plating diverted to any other object is doubly suicidal, as in addition to the inroads of shot, we have now to provide for the new agent in warfare, the ram.

The "Royal Sovereign" being a converted vessel, it might be considered unfair to allude to her; but the question is only one of degree. The "Royal Sovereign" requires 611 tons to protect five guns, while the "Monarch" and "Captain" each take above 500 tons (I have not the exact figures) for protecting four guns.

The whole of the plating being required for the wind and water-part of the vessel, if the guns and their crews are to be protected by plating, it can only be done on the "revolving principle," which brings *the guns under cover of the water-line plating for being loaded, and afterwards revolves them into action.*

The "revolving system," which I will now endeavour to describe, is capable of considerable modifications to suit the varied circumstances of both sea and land warfare, but the same principle is to be found in all.

Two similar guns, or a gun and its equivalent weight (Plate xxix, fig. 5), being placed parallel and opposite to each other on the same framework, and equi-distant from a common axis of rotation, must counterbalance each other. This must be kept in view, otherwise it will be difficult to divest the mind of the natural, though erroneous idea, that the gun, while recoiling in a descending arc, will have its momentum accelerated by gravity.

Here may be seen a wheel revolving vertically on an axle, with all its parts equally balanced, so that in whatever position any point in the revolving surface may be momentarily placed, in that position it will remain; and when set in motion the wheel will revolve with equal velocity, whether the power be applied in an upward or downward direction, and the same will be the case with two similar guns placed equi-distant from the axis of rotation, with their centres of gravity connected by a straight line passing through this axis.

Having cleared away any apparent difficulty from the action of gravity, we will next consider the means for controlling the recoil.

There are several modes in which the recoil may be stopped, a description of three of them will show the powerful means at command.

As the most ponderous machinery may be stopped while revolving by the mere application of a friction surface, so the same means may be applied to control revolving guns, by attaching two friction wheels to the brackets, one on each side of the gun; another mode, from its great

power and simplicity, will equally commend itself to our attention, as the heaviest recoil may be stopped without occasioning the slightest strain, by merely causing the gun to raise a weight temporarily attached to the framework underneath its muzzle (as shown in the diagram No. 6, Plate xxx); this weight will be considerably less than the force exerted, from the levers D A, or E A being more powerful than the levers B A and C A, the former representing the length of the lever attached to the weight, the latter the length of that on which the explosion of the charge acts.

But whether in theory or in practice, I think it will be admitted that nothing can be simpler or more complete than the recoil being subdued by the mere raising of a weight, particularly when such weight may be made heavier in its ascent, as would be a chain with links of increasing weight.

The recoil may thus be got rid of, or by lifting the breaks no harm would arise, if it expended its force in a circular direction by the guns revolving on their common axis, but by either method the injurious strain on the vessel is got rid of, an important advantage in all ships, particularly in those constructed of iron; the third plan, which I will presently describe, brings the weight of the guns directly on the friction wheels.

It should be observed that the rolling of the vessel cannot affect the recoil under the revolving system; the fearfully accelerated movement which this motion now adds to the recoil is, therefore, no longer to be feared, and weather guns will no longer leap in, and set at naught the puny restraints of breechings, tackles, and compressors.

The danger in heavy weather of the weather guns breaking loose from all control is so great, that, with a vessel heeling over considerably, an officer will hesitate before attempting to fire them with heavy charges, or indeed any gun directly ahead or astern (as there will, in this latter case, be considerable risk of their turning over on their sides), while a ship, for instance, is heeling over some 20°. The "Bellerophon" could not fire her guns when rolling 13°. Even on shore, without the accompanying lurch which gives such a powerful impetus to the movement, it would be a somewhat awkward experiment to fire a gun across an incline of 20°, or to allow it to recoil down it; and some of our ships indulge in heavier rolls than this.

A man-of-war should, under all circumstances of weather and position, be able to fight her guns with effect, or she becomes defenceless, and practically vacates her office.

But, under the "revolving system," whether it be to windward or to leeward, ahead or astern, in a gale or a calm, without either breechings or tackles, restrained merely by the axis on which they turn, and uninfluenced by the motion of the vessel, "revolving guns" can always be fired with perfect impunity and effect.

But to proceed with the description; there are several distinct forms in which the revolving principle can be applied, all of which permit the guns to be turned in a horizontal direction, and to be loaded and (whenever desired) to be aimed under cover, the crew being always under shelter of the plating when working the guns.

First position
Second position
Second position
No 1
No 1
No 2
No 3
OBJECT POINTER
No 6
A
B
C
D
E
F
W

Under form No. 1 (Fig. 1, plate xxvii) are to be seen two side brackets with holes at the ends of their longest arms for receiving the trunnions of two guns placed opposite, parallel, and in a reverse position to each other, and equi-distant from an axis for vertical revolution, which passes through the centre of the brackets, the breech and muzzle of each gun being secured by iron fastenings to the ends of the shorter arms, which support two deck-slips, the latter having a port working on hinges under the muzzle of the gun, and when extended, the deck-slip and its port together form an exact counterpart in shape of the opening in the upper deck, through which the guns pass while revolving. When the guns are below for being loaded, they completely close the aperture, descending simultaneously with the guns rising for being fired. As the guns balance each other on the opposite sides of the brackets, so, in like manner, do the deck-slips, and thus an equilibrium is established which reduces to a minimum the labour of revolving the guns, and this labour is consequently so slight, that, with the friction-band raised, the smallest additional weight attached to any part of the deck-slips or guns, will cause that part to gravitate.

The revolving movement in the vertical plane is conducted by a purchase-wheel, turned by a crank handle; in this movement are embraced four distinct operations—the bringing the gun into action, the giving it elevation and depression, and the recoil, or running in; and no plan yet devised has combined these distinct duties in a manner so simple, and yet so perfect.

With respect to the "elevation," it is practically unlimited, the whole arc of 180° being under command; in consequence of which vertical fire, one of the most important aids in modern warfare when attacking bomb proofs and land defences, can be employed with the same ease and facility as if the firing took place in a horizontal direction.

The very limited elevation to which broadside, turret, and box-guns are confined, entirely prevents vertical fire being thought of on board vessels armed on these respective principles; and yet the necessity for avoiding torpedoes will keep our ships further from the shore, and compel them, as far as possible, to fire at higher angles of elevation.

But unlimited elevation is of great value under other circumstances, for if a vessel were stranded on the rocks, and on her beam ends, under an enemy's guns (as has happened), the guns, under the revolving system, could be fired with as much effect as if the vessel were on an even keel.

As regards "depression," it can be given to any necessary extent, either by increasing the length of the brackets, or by raising the revolving axis.

It will be observed that whenever a deck-slip occupies the aperture, the deck will present a flush appearance fore and aft.

No. 2,* in its general features, embraces the same points as No. 1, but has, in addition, a protection of iron plating attached to the

* A diagram of this is not given.

guns themselves, as also two side shields of iron affixed to the rotary deck on each side of the opening through which the guns revolve, which shields, in the event of their becoming injured, can be moved outwards by screws. The protection will now be complete, without requiring an eighth of the weight a turret takes.

No. 3 (Fig. 3, plate xxviii), although in principle the same, differs from the two last in the absence of deck-slips, and in the framework being circular, and made to fill the aperture in the deck for the exclusion of water. Two holes in the circular framework, or disc (in which the muzzles of the guns are permanently fixed) forming the only breaks in the circle, the firing can thus be continued while heavy seas are washing over the decks and guns. The disc is of variable thickness for economising the weight. The effect of this economy of weight and space, as compared with a turret, is a restoration of the guns to the vessel's broadside, where a series of revolvers, extending the length of the vessel, might be worked in any weather with perfect ease.

No. 4 (Fig. 4, plate xxix) shows another mode of applying the revolving system; in this case the connecting rods are no longer attached to the smaller arms of the brackets, but extend across from gun to gun; this allows the guns to work on their trunnions, and to move while revolving with a parallel motion, so that the upper gun can be brought more quickly under cover, in a smaller arc of revolution, by the mere insertion of a detaining bolt in the centre of one of the connecting rods: an automatic withdrawal of this bolt may afterwards take place, should a further extent of recoil be desired.

If the bolt remains undrawn, or by a self-acting contrivance be returned into its detaining position, the gun, when re-loaded, may be revolved into precisely the same position as it occupied when fired.

When the parallel motion is used, the elevation and depression have to be given by raising or lowering a movable arm, into which the detaining bolt has been inserted.

Fig. 5, plate xxix, has the same parallel motion as No. 4, but varies considerably in form, as the weight of the guns themselves is applied to the friction surfaces to check the recoil; this may also be seen in plan No. 1.

The friction wheel, *a*, with its fellow-wheel on the other side of the guns, together form a second axle, which, with the axle proper, will remain locked while the gun recoils, and thus afford an extended surface on which the two guns and their gear will press so heavily, that the friction produced will far more than suffice; the extent of this surface may be roughly estimated by the length of the upper halves of the two wheels multiplied by the breadth of the trunnions: thus, with wheels 8 feet in diameter, with friction surfaces a foot in width, there will be 24 square feet of surface, on which the whole of this weight will press equally.

To compare a 12-ton revolver with a 12-ton gun fired on shore with the same amount of recoil friction, this latter gun must have another similar gun, or an equivalent weight lashed to it, and the whole made to rest equally on 24 square feet of friction surface.

When No. 5 is applied to vessels of small tonnage and light draught,

for which it is admirably adapted, instead of a second gun there might be substituted an iron box containing some of the vessel's spare gear, such as spare shackles, a length or two of chain, or any weighty and compact articles.

A point of very great advantage (not found under any other system) is the immovability of the common centre of gravity of "revolving guns;" no ill effects can, therefore, arise from the recoil of a broadside of heavy guns while the ship is heeling over.

The horizontal motion need not occupy any time in verbal description, as, owing to the weight resting principally on a central pivot and rollers, it can be accomplished with the greatest ease, particularly as there is no heavy turret of some 250 tons to be added to the weight to be moved.

There are several modes of aiming the guns, as, for instance, the captain of the gun can stand in its rear and conduct the pointing, and having the gun between the enemy he is firing at and himself, is then less exposed than he would be in a turret, where a shot entering the port might take him in the body.

In No. 2 or No. 3 plan, the man aiming would neither have his head nor his body exposed, as he would look through an aperture like a telescope in the iron disc immediately over the gun; within this aperture is the dispart, and at its inner and wider end, a tangent scale.

The back of the person aiming would certainly be exposed; this, if desired, could be obviated by a protecting band of plating extending across from one side-shield to the other.

The steadiness of aim, another point, is greatly aided by the gun recoiling under the feet of the person aiming, who no longer need spring up to prevent the gun striking him; but it is not necessary that he should even be near the gun, as the instrument I am about to describe will show.

The "object pointer" (see Plate xxx) is an instrument by means of which a person in some place of security at a distance from the gun can direct the gun with the same accuracy as if he were in the rear of it. The instrument is connected by rods with an eccentric or crank on the central pivot of the guns; the gun and the instrument will, therefore, partake of the same movement, the act of turning the guns moving the instrument in the same direction.

A person sitting behind the pointer can, through a voice-pipe, direct the guns to be trained to the right or left hand, and to be elevated or depressed, until he observes the pointer bearing on the object, when the gun will be found pointed in a similar manner; he might then pull the trigger line as if he were ringing a bell.

Except in the case of gun-boats and other small vessels, the broadside is the proper position for a vessel's guns, for which "revolving guns" are admirably adapted; and if we once get rid of the ponderous turret, however heavy the class of guns, their aggregate weight will never approach the aggregate weight of all the guns carried by a three-decked ship on her broadside; there will, consequently, be no difficulty on the score of weight.

After the safety of the water-line has been secured, every ton of

weight that remains undisposed of should be turned into guns, every additional gun constituting a distinct chance of success. Much has been erroneously said of the advantage of concentrating the efforts of a broadside in a single shot, which, however plausible in theory, is untenable in practice as long as the percentage of misses so greatly outnumbers the percentage of hits; there is, indeed, no greater defect among the recent changes (for which no increase of size will compensate) than the great reduction in the number of the guns carried. The difficulties of taking a correct aim at sea appear to have been entirely overlooked.

Assuming for a moment that large guns can be handled as quickly as smaller ones, and that the crews are equal in practice, the vessel carrying a few guns must inevitably be sunk before she can make a successful hit, when engaging a vessel armed with a greater number.

Let us for instance say that five per cent. of the shots will prove successful, then the "Royal Sovereign," as a turret ship, before she could plant a single successful shot, would have to fire *four* entire broadsides; when the same vessel, if the 614 tons of turrets were got rid of, and some forty 12-ton guns substituted, would at the same rate of percentage, make a successful hit at every broadside.

With respect to the mechanical part of the question, no engineer of experience would find the smallest difficulty in revolving ordnance of 25 to 100 tons weight with the same ease and facility as Brunel revolved a paddle wheel of the "Great Eastern" of 185 tons on its semi-supported shaft.

While showing that guns of any size can be worked on the "revolving system," I would especially remark, that I do not advocate in the slightest degree the employment of those enormous mistakes, which, with wide diameters of bore, are fired with less than their saluting charges, and with a smashing, rather than penetrating power, are but carronnades on a large scale.

The difficulties which the weight of plating, entails, and which, I trust, the "revolving system" will obviate, appear to be so pressing on the authorities, that vessels with only a 4 feet 6 inches freeboard have been proposed, and are, I fear, already laid down; as such vessels, if caught in a heavy gale and sea, will, from the operation of the same causes, in all probability, meet with the same fate as the unfortunate "London," I will briefly, by means of these models, endeavour to show that a vessel's freeboard cannot, with a due regard to her safety, be reduced to the extent proposed, and that the height of the freeboard must be a variable quantity, which, within certain limits, will be found to increase with the length of the vessel, so that a short vessel of ordinary construction can enjoy a height of freeboard, which would prove fatal to a longer vessel.

All vessels, as is known, displace, without reference to their form or position in the water, a body of water of the same weight as themselves, and this invariable law causes them to float higher, or to sink deeper, according to the increase or diminution in the bulk of their hulls at the part then subjected to the passing wave, that the same displacement may at all times be maintained.

While scudding before the wind, with the seas rolling onwards at a greater velocity than the vessel, the entire length of the hull is incessantly traversed by rolling volumes of water, which, as they pass the widely differing displacements at the quarter, beam, and bow, occasion the incessant changes in the immersion and emersion of the hull, to which I have alluded; a vessel of great length relative to her beam, when on the crest of a wave at her centre, will sink into it, until she has found in its widening base the amount of displacement she has been momentarily deprived of by the exposure of her unsupported extremities, the weight of which will then press on her, as would an additional weight of cargo suddenly placed on board, and the crest of the wave, then towering above the decks, will fall, sweeping them with resistless force.

I will now describe the effect of a wave while passing the centres of a long and short vessel having the same displacements (Plate xxx).

The vessels are respectively numbered 1, 2, and 3, and are of the following dimensions:—

No.	Length.	Breadth.	Depth.	Draught.	Displacement.	Freeboard.
1	20	5	3	2	200	100
2	10	5	3	2	100	50
3	10	5	3	2	100	50
					400	

The three vessels have an aggregate displacement of 400, and whether floating separately, attached side to side, or end to end, this will continue to be their displacement.

When placed side by side they will form a vessel 20 long by 15 broad, and when end-on, one 40 long by 5 broad; we will first place them side by side, and having shown the height of the freeboard occupied by a wave at their centres, will then place them end on, and observe the result, applying the same shaped wave at the same part of their hulls.

The wave is drawn with its sides at an angle of 45°, and is marked with cubes, the same as the models, to facilitate computation with the eye, the sides then occupying the diagonals of the cubes, which will be sufficiently accurate for the present purpose.

(The side of a wave is frequently to be seen at a much higher angle.)

A vessel of two beams in length (here formed by a lateral junction of the models) is supposed to be momentarily supported on the crest of a wave at her centre, which will leave 40 cubes of the previously immersed portion of the hull exposed to view at each extremity, 80 cubes must therefore be taken from the freeboard to supply the loss, which will still leave a sufficient height of freeboard above the highest point reached by the waves, to insure the vessel's safety.

If the vessel be now divided longitudinally, and Nos. 2 and 3 be taken from the side of No. 1, the displacement and line of flotation of the latter will in no wise be altered, but if instead of attaching Nos. 2

and 3 to the sides of No. 1 (where they support themselves) we add them to the ends of No. 1, transforming all three into a vessel of eight beams in length, there will be a very altered state of circumstances, as Nos. 2 and 3 will then be entirely out of the water, and contributing nothing by their displacement to the support of their own weight, will press on No. 1 with their entire weight, forcing it down, until in the base of the wave, is met a sufficiency of water to supply the three combined vessels with the 400 tons of displacement they require.

The correctness of this may be ascertained by counting the cubes described behind the wave, the crest of which from there being no freeboard sufficiently high to restrain it, will pour over the vessel in a huge volume of water.

From this we may trace the proximate cause of the unfortunate "London's" disaster. She was of great length, with small proportionate beam, and very low in the water (without a sufficiency of freeboard in fact) and she foundered in a sea-way in which her own open boats (deeply laden) could live, and from the account of the survivors, who described the sea as falling in masses on her decks, we can have no doubt that when across the crest of the waves, as they reached her centre, she sunk so far into them that the water fell in successive seas over her imperfectly secured decks, and the same unhappy fate will attend any long low turret vessel caught scudding or athwart the waves with a heavy sea on.

If, therefore, the safety of the vessel and her crew are to be at all regarded, there must be no diminution, but a large increase of the freeboard in the long low vessel; turret and box vessels, equally with broadside, are under precisely the same conditions as regards the height of their freeboards, and we cannot recognize the claims of their advocates for a special exemption from the general law.

I will now briefly enumerate some of the principal advantages which the "revolving system" offers.

1. It requires no armour-plating for its special protection, and enables all that is now placed on the top sides and turrets to be employed in the more important office of protecting the "wind and water" part of the vessel.

2. Or in the event of not being required for such a purpose, it relieves so much dead weight, which can be devoted either to a large increase of the armament, or to a considerable decrease in the size of the vessel.

3. From its lightness and compactness, it is adapted both for a ship's broadside, and for the smallest gun-boat.

4. It affords complete protection both to the guns and their crews.

5. It requires neither breechings or tackles in the heaviest weather, and the guns, although movable, are yet always permanently attached to the vessel by the axis on which they revolve, which latter only turns in a horizontal direction.

6. The centre of gravity of the guns, whether they are being fired, or otherwise moving, is always immovably fixed.

7. The guns can be elevated through the entire arc of 180°, and con-

sequently vertical fire, which has hitherto been confined to mortars, can be commanded in all vessels.

8. A greater degree of depression than has hitherto been attempted can be given without the present serious increase of weight required in turrets.

9. There being no heavy turrets to move, nor guns to transport (as in box vessels), the horizontal training can be performed with greater rapidity and ease than under any other system.

10. The "elevation," "depression," "running out," and "running in," are all comprised in the one vertical movement, and require neither steam power nor the employment of any greater number of men than are necessary for spongeing and loading.

11. The guns are loaded entirely under cover of the freeboard-plating, and from the inclined and convenient position of the gun, with greater rapidity than under any existing system.

12. While one gun is being aimed the other can be loaded.

13. Although unnecessary (from the labour being so light) the recoil of one gun can be made to bring up the other ready for action.

14. The guns being entirely independent of the motion and inclination of the ship, can be fired in all weathers, and in any position, which no other gun yet invented is capable of.

15. "Revolving guns" require no greater security in a gale than in a calm, and can always be kept in a state ready for action.

16. Owing to the guns (or to one gun and its equivalent weight) balancing each other, a gun can be brought into action, or withdrawn from action, without having been discharged, by the mere turning of a winch-handle.

17. The injurious vibration caused by the explosion of heavy charges becomes neutralized by the recoil taking place in a circular direction.

18. The steadiness of aim is greatly increased, as the person aiming has not to spring up to avoid the recoil.

19. The guns can be fired with the sea washing over them, without the water getting below.

20. If, for any purpose, a turret be desired, its iron plating, greatly reduced in height, diameter, and weight, and without a port, may become a fixture, by revolving guns passing through its roof.

I wish, before concluding, to make a short allusion to Captain Moncrieff's gun, which, although widely dissimilar in form, to a certain extent seeks the attainment of the same object for the land service. Having never seen the gun, I can only quote from the copy of the patent, and from the description given by the public papers.

It appears that a gun is attached to the outer part of a wheel, which moves to the rear when the gun is fired, causing the latter to descend under cover, in a cycloidal curve, the force of the recoil at the same time raising a weight attached to the wheel, which afterwards, by gravitation, on the release of a bolt, restores the gun to the position it occupied when fired.

The governing principle seems to be the "storing up" (the words used) of the force of the recoil for bringing the gun into action, but

and 3 to the sides of No. 1 (where they support themselves) we add them to the ends of No. 1, transforming all three into a vessel of eight beams in length, there will be a very altered state of circumstances, as Nos. 2 and 3 will then be entirely out of the water, and contributing nothing by their displacement to the support of their own weight, will press on No. 1 with their entire weight, forcing it down, until in the base of the wave, is met a sufficiency of water to supply the three combined vessels with the 400 tons of displacement they require.

The correctness of this may be ascertained by counting the cubes described behind the wave, the crest of which from there being no freeboard sufficiently high to restrain it, will pour over the vessel in a huge volume of water.

From this we may trace the proximate cause of the unfortunate "London's" disaster. She was of great length, with small proportionate beam, and very low in the water (without a sufficiency of freeboard in fact) and she foundered in a sea-way in which her own open boats (deeply laden) could live, and from the account of the survivors, who described the sea as falling in masses on her decks, we can have no doubt that when across the crest of the waves, as they reached her centre, she sunk so far into them that the water fell in successive seas over her imperfectly secured decks, and the same unhappy fate will attend any long low turret vessel caught scudding or athwart the waves with a heavy sea on.

If, therefore, the safety of the vessel and her crew are to be at all regarded, there must be no diminution, but a large increase of the freeboard in the long low vessel; turret and box vessels, equally with broadside, are under precisely the same conditions as regards the height of their freeboards, and we cannot recognize the claims of their advocates for a special exemption from the general law.

I will now briefly enumerate some of the principal advantages which the "revolving system" offers.

1. It requires no armour-plating for its special protection, and enables all that is now placed on the top sides and turrets to be employed in the more important office of protecting the "wind and water" part of the vessel.

2. Or in the event of not being required for such a purpose, it relieves so much dead weight, which can be devoted either to a large increase of the armament, or to a considerable decrease in the size of the vessel.

3. From its lightness and compactness, it is adapted both for a ship's broadside, and for the smallest gun-boat.

4. It affords complete protection both to the guns and their crews.

5. It requires neither breechings or tackles in the heaviest weather, and the guns, although movable, are yet always permanently attached to the vessel by the axis on which they revolve, which latter only turns in a horizontal direction.

6. The centre of gravity of the guns, whether they are being fired, or otherwise moving, is always immovably fixed.

7. The guns can be elevated through the entire arc of 180°, and con-

sequently vertical fire, which has hitherto been confined to mortars, can be commanded in all vessels.

8. A greater degree of depression than has hitherto been attempted can be given without the present serious increase of weight required in turrets.

9. There being no heavy turrets to move, nor guns to transport (as in box vessels), the horizontal training can be performed with greater rapidity and ease than under any other system.

10. The "elevation," "depression," "running out," and "running in," are all comprised in the one vertical movement, and require neither steam power nor the employment of any greater number of men than are necessary for spongeing and loading.

11. The guns are loaded entirely under cover of the freeboard-plating, and from the inclined and convenient position of the gun, with greater rapidity than under any existing system.

12. While one gun is being aimed the other can be loaded.

13. Although unnecessary (from the labour being so light) the recoil of one gun can be made to bring up the other ready for action.

14. The guns being entirely independent of the motion and inclination of the ship, can be fired in all weathers, and in any position, which no other gun yet invented is capable of.

15. "Revolving guns" require no greater security in a gale than in a calm, and can always be kept in a state ready for action.

16. Owing to the guns (or to one gun and its equivalent weight) balancing each other, a gun can be brought into action, or withdrawn from action, without having been discharged, by the mere turning of a winch-handle.

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when the gun misses fire, or is fired with a reduced charge, and has to be brought under cover, the application of considerable additional power, more than equal to the force of the recoil, appears to be necessary.

A very essential difference between the two systems is at once apparent, the "revolving guns" being always equally poised, work on a securely fixed axis in a circle (instead of a detached one on a cycloid), are independent of the recoil, and can be brought in and out of action with very trifling labour, a seven-ton revolver only requiring seven tons, or even less, and which may be a spare gun, instead of 14½ tons of elevator and ballast for the movement.

With revolvers, vertical fire can be given, and these guns can be elevated and depressed to any extent by the same movement which brings them into action.

With Captain Moncrieff's guns the first appears to be impossible in any shape, while the latter is very limited and requires a screw and a distinct operation; it does not appear that this system is capable of affording the thorough protection which is to be found under the No. 3 mode of applying "revolvers;" but I will not pursue the comparison.

Enough has probably now been shown to prove that the "revolving system" possesses no common advantages, and that it is capable of a wide development; the limited time at my disposal forbids my describing the advantages it possesses for the land service.

In referring to other systems, I have endeavoured, and I trust successfully, to avoid giving offence to those interested in them.

I have shown that our supposed impenetrable fleet of iron-clads are in no safer position than wooden vessels, and that a remedy lies at our doors, and I would ask whether it be wise to neglect for a day the great interests now at stake.

Let us remember that foreign powers are quite aware of the weak points of our position, and that so long as that position is assailable we invite attack; that all our gun-boats are below the mark, and will be swept away, and that the weak plating of our iron-clads will be easily penetrated by comparatively small guns, are not my remarks, but the remarks of those whose experience and opinions cannot be lightly disregarded at a time, when that cloud in the far west may rapidly increase and cover our waters and destroy our commerce, with fleets of hostile gun-boats, quickly extemporized, with which our present iron-clads will find it difficult, if not impossible, to cope successfully.

The CHAIRMAN: There are one or two points which I should like to have elucidated. The first is, what is the depth of hold required, and what would be the draught of water in a gun-boat to carry two of those guns? Next, I do not make out in what position of the gun the loading takes place? Again, in the case of any accident happening to the lower gun, such as its bursting, it seems to me that it would be fatal to the whole apparatus. Then, I think you mentioned that one gun might be loaded whilst the other was being pointed. If the two guns are attached in that way, I cannot conceive how the captain of the upper gun can point accurately to half a degree without being disturbed by the ramming home of the charge of the lower gun.

Captain SHARPE: I may say that the question of loading the two guns, the lower one being loaded when the upper one is being fired, is quite a secondary object, and is only intended for rapid firing at close quarters.

The CHAIRMAN: Then the second might do as a spare gun.

Captain SHARPE: Yes. I attach no great importance to the lower gun, except as a spare gun, or for rapid firing, and for alternating with the upper gun (to avoid heating). The upper gun, as you see, can, in every case, be loaded under cover. In some cases, I have applied a weight below instead of another gun.

Mr. MICHAEL SCOTT, C.E.: I should like to ask in what kind of vessel you propose to employ these guns? I understand that you object to the turret system. I believe that you desire to have a high free-board, and that your guns would be carried on the broadside exclusively. My inquiry is more with reference to the relative weight of metal required for the turret and the broadside.

Captain SHARPE: The first question was, does the vessel for this gun require any great draught of water? No, it does not; and provided you adopt this form (showing) you may have the gun of any size you like. You can judge of the draught by the length of the gun. A very shallow draught will do. That is what Mr. Watts appeared so struck with. The smallest vessel would admit the gun. You can judge the depth required by taking the length of the gun as a guide. The next question was, how does the loading take place? When you are firing in this way (showing), you will, of course, load with the gun horizontal, under cover. But if you revolve the guns, you would load at an angle of about 45° (Fig. 1); the shot and the charge would almost roll in.

The CHAIRMAN: I am afraid they would roll out again on the gun going round.

Captain SHARPE: The gun revolves, so that the shot rests on the bottom of the gun. If the order were given for 10° of elevation, the elevation could be given thus. You see by this model that this gun can be loaded while the other is being pointed; but, as a practical man, I do not attach any importance to that, except when you are alongside an enemy, and wish to rattle in your shot as fast as you can. I do not care much about *using* the lower gun, except as I have stated, but I do care about having a *second* gun, because if the upper gun gets damaged, there is another gun to revolve immediately into its place, with the same gear and the same facilities for firing.

Captain BURGESS: Would you not have to attach a weight in its place if the upper gun were to get injured, and you have to unship it?

Captain SHARPE: We should not unship it, we should keep it, although injured, as a counterpoise. The question was asked what kind of ship would carry these guns? Any kind of ship you might apply them to (as I mentioned in my paper), even to the turret. You might cut the turret down one-half, and let the gun pass through the top. Still, I think it is a gunnery mistake to have a central gun. Here is a section of the "Warrior" (showing diagram), with two 12-ton revolving guns on the same scale, mounted on the broadside. Taking the upper plating off, and adding it to the sides below, several such revolving guns can be used, and also be protected, and the "Warrior" turned into a more valuable frigate, with much thicker plating on her sides.

The CHAIRMAN: Would you not, as a general rule, carry heavier guns on the mid-ship section, not only as to the disposition of weights, but a larger gun requires a larger revolving apparatus? Would it not be better to carry that larger apparatus on the midship section, with depth of hold in the centre compartment, than on the sides?

Captain SHARPE: Undoubtedly, if you have the apparatus on a very large scale. But in this section of the "Warrior" you see the apparatus for two 12-ton guns scarcely extends beyond the decks.

Mr. MICHAEL SCOTT: I am very much pleased with your double axle.

Captain SHARPE: Yes, the moment it occurred to me, I felt not a doubt of its value.

Mr. MICHAEL SCOTT: You are in favour of a high free-board?

Captain SHARPE: Yes, but with a low protection only.

Mr. MICHAEL SCOTT: Would you carry that protection below the water-line?

Captain SHARPE: Undoubtedly.

The CHAIRMAN: If no other gentleman wishes to make remarks, it is my pleasing duty to ask the meeting to join me in thanking you, Captain Sharpe, for your very good and entertaining lecture. The subject is quite new to me. Having heard your explanation, I really cannot see any of those difficulties which I must say I anticipated, when I first came into the room. Your plan seems to me much more feasible now, though there are some of the details in which practice might show modifications to be necessary.

Evening Meeting.

Monday, May 17th, 1869.

WILLIAM STIRLING LACON, Esq., in the Chair.

NAMES of MEMBERS who joined the Institution between the 3rd and 17th May, 1869.

ANNUAL.

Bannister, C. W., Major late 2nd Bombay Cavalry. 1*l.*
Haye, J. B., Lieut., R.N. 1*l.*
Whiteside, F. J. S., Capt. 11th Regt. 1*l.*

THE CONSTITUTION OF OUR MILITARY FORCES, AND THE CONDITIONS OF MILITARY SERVICE.

By Colonel A. Cunningham Robertson, Commanding 2nd Batt., the 8th or King's Regt.

Mr. President and Gentlemen—You are aware that when the Council accepted my offer to say a few words by way of introducing this subject for discussion, they knew that I had no intention to submit for the consideration of the members of the Institution, any complete plan of my own. What I proposed to do was, to endeavour to classify and analyze what had been written and spoken on the subject of the reorganization of the Army, with the view of giving an opportunity for the discussion of those points regarding which a difference of opinion exists. At the time I offered to undertake this task, it did not appear very formidable; but since then there has been so much written and so much spoken on this subject, that I have found it rather difficult to make myself familiar with all the opinions and suggestions which I had to examine. I have, however, worked diligently in order to accomplish what I promised. I have made notes from all the pamphlets which have been written on the subject, and from the newspaper reports of all the speeches that have been made in Parliament. The result is this bulky roll of MS. which I hold in my hand. I shall not attempt to read these notes to you in their present shape, as I am sure that they would be neither interesting nor easily understood. I hope, however, to be able to submit them to the Council in a more compressed form, and should they think fit to publish them, they will, I think, be found to embody a tolerably complete

abstract of the actually existing state of opinion at this most interesting epoch in the history of our Military Institutions when, under the auspices of His Royal Highness the Duke of Cambridge, it seems likely that even greater changes will be made, and even greater improvements effected in the organization of the Army, than those changes and improvements which have rendered memorable the period during which his illustrious predecessor, the Duke of York, commanded the Army.*

The declaration of the policy of the Government made by Lord Northbrook leads me to hope that the Ministerial programme will, if adopted by Parliament, give practical effect to most of the suggestions made by Sir Charles Trevelyan. Many of these suggestions, which thirty years ago would have been irreconcilably at variance with the feelings and convictions of the Officers of the Army, are now in perfect accordance with the opinions and sympathies of most Officers who have studied the subject. Of course, however, those who undertake to introduce changes in existing institutions must always be prepared to contend with difficulties and to overcome opposition. There is always a certain inevitable amount of opposition to be encountered, which proceeds from the united forces of ignorance, of prejudice, and of adverse personal interests. To attempt to overcome opposition of that kind by reason or argument would be futile. The only practical manner of dealing with it is, to estimate its amount, and to consider whether it is most prudent to disregard it or to repress and control it by the direct intervention of authority. But there is another kind of opposition which arises, not from passion or prejudice, but from the difficulty of appreciating correctly the various conditions and circumstances which must be taken into account in estimating the effect likely to be produced by any proposed measure. A comparison of the different estimates formed by different individuals of the effects likely to be produced by the same measure; and a discussion of the grounds on which these estimates rest, must, I think, tend to modify and diminish differences of opinion. If a measure be really good and expedient, the more fully and the more frequently it is discussed, the smaller will become the minority of those who oppose it, the greater the majority of those who approve of it.

In going over the very numerous and highly important topics included in the subject of this evening's discussion, I shall therefore either altogether omit or else touch very slightly on those points concerning which all, or nearly all, who have written or spoken on the subject seem to be agreed; and shall devote the short time at my disposal, to making a few observations on those points respecting which there still exists a considerable difference of opinion.

What we want to do, stated in general terms, is this—We want so to organize our national forces and resources as to render them available for the purposes both of offensive and defensive warfare, and to provide for every requisite service being performed in the most economical manner, consistent with perfect efficiency. But although military

* Vide Appendix.

efficiency is the chief and primary object to be kept in view in organizing our Military Institutions, Sir Charles Trevelyan has pointed out that a statesman who deals with this question ought to bear in mind that these institutions exercise a permanent and constant influence over the national character, extending over periods of peace as well as over periods of war, and that the duration of periods of peace always greatly exceeds the duration of periods of war. Hence, therefore, although subsidiary and subordinate to the paramount requirements of military efficiency necessary to secure success in war, it is nevertheless an object of the greatest national interest to impress such a character on our Military Institutions as to make their operation during time of peace beneficial to the population, and to make the influence they exert, favourable to the development of the moral and intellectual, as well as to the physical energies of the labouring classes. In one of the most interesting passages of that most instructive little work which has become the text-book of all who wish to attain an accurate knowledge of what the British Army actually is, and also a distinct idea of what it ought to be and might be, and it is to be hoped will soon become, Sir Charles Trevelyan points out those particular arrangements by which the special processes of military training might be made subservient to a general scheme of popular education, so that a year's military duty might, in the education of young men of the labouring classes, produce beneficial effects analogous in kind to those which are produced by university training in the education of young men belonging to the upper classes of the community.

Sir Charles Trevelyan's views respecting this subsidiary function of Military Institutions are confirmed by the authority of General Trochu. As regards this matter, the views of the distinguished French soldier and of the distinguished English civilian are identical. On a point of that kind a complete coincidence of opinion between two such eminent, and at the same time such completely independent authorities, is conclusive; and in any future attempt to frame a scheme of national military organization, the necessity of rendering military training a means of promoting success in civil occupations will, no doubt be recognized as an essential condition of the problem.

What we mean, then, by an efficient Military Organization of our national forces is, not merely an organization which shall produce an Army thoroughly trained in military exercises, and perfectly adapted for all the purposes of war, but, further, an organization which shall render military training a powerful instrument of popular education, so that the same process which renders a young man an efficient soldier shall also improve his character, and develope his bodily and mental capacities, rendering him in every respect a more perfect man and a better citizen. I think we are all agreed that this is what we want to do, that this is the kind of organization we want to attain. I think, also, that it is very generally believed that those things which we want to do, the Prussians have actually done; and that such an Army as we want, they have got. Does it therefore follow, that to obtain the same results the best thing we can do is to make use of the same

means? Many people think so. They say no country in the world has a more efficient Army than Prussia. No country is better prepared for war. Therefore, say they, let us imitate Prussia; let us adopt Prussian institutions. It has, however, been very forcibly pointed out that in many most essential respects the circumstances of England are very different from those of Prussia, and that the conditions of security being different, that kind of organization, and those methods of defence, which are indispensable for Prussia, are by no means necessary for England, nor in any respect so suitable as are other organizations and methods. The security of Prussia altogether depends on the efficiency of its Army; but the Army is not the sole nor even the chief defence of England. We are protected by the ocean, by the floating bulwarks of our magnificent Navy, by the formidable fortifications which cover our chief arsenals and harbours. The Channel, to use the words of Lord Northbrook, is "our natural ally;" and if this is forgotten in considering how to organize our military forces, we omit from the problem the most important of the conditions which determine the method of its solution. Prussia cannot be effectively defended unless its armies are able to leave their own territories, and to assail their enemies on a foreign soil, and on battle-fields far distant from their own frontiers. For England, on the contrary, the best method of defence will generally be to await attack. By adhering to this policy, we shall be able to make our preparations for resistance under much more favourable conditions than the Prussians. We shall be able to obtain an equal, or, rather, a much greater degree of national security by means of an organization much narrower in its objects, and much less stringent in its provisions.

As regards the particular measures most suitable for the defence of England, a great variety of suggestions have been made, and some of these differ very considerably from others; but after reading a large mass of pamphlet literature, reports of parliamentary debates, and newspaper articles, what struck me most, and what I think will strike any one else who goes through the same course of reading, is, not the diversity, but the great similarity of these suggestions. As regards general principles, there is a very striking concord of opinion. As regards matters of detail, though there is considerable diversity, yet methods which differ are not always contradictory. Some suggestions which differ, are really supplementary to one another; both are capable of being usefully combined in the same scheme, *e.g.*, Colonel Baker has suggested a mode of recruiting the Militia by ballot, not as a substitute, but as a supplement to the mode of recruiting by voluntary enlistment.

The mode of enlistment is the essential point which determines the character of the military institutions of a state, and is one of those points on which absolute unanimity of opinion exists. Every one is agreed that in time of peace, to make military service *compulsory* would, in this country, be practically impossible. *Conscription* in England is certainly impossible; but is it equally certain that, if possible, it would be inexpedient? that if a statesman had it in his power to choose whether the national forces should be

raised by voluntary enlistment or by conscription, the highest interests of the nation, namely, those which affect the morality of the people, demand that he should decide for voluntary enlistment? This is what Lieut.-Colonel Bannatyne thinks. In his very able pamphlet, published in 1867, called "Our Military Forces and Reserves," after describing the Prussian system of conscription, he says:—"Every adult, able-bodied male in this population is thus made a soldier. Such a system cannot but demoralize the whole population, and unfit them for the occupations of civil life."

I wish to lay emphasis on the word "demoralize," and to contrast this opinion as to the moral effects of conscription with that of Sir John Burgoyne. Like everybody else, Sir John admits that it may be good economy to pay a large sum out of the Treasury, and to spare the industry of the nation. "Man for man," he says, "a soldier in the "British Army costs much more than a soldier in the French or Prussian Army." Nevertheless, speaking economically, we may be gainers, and wise in our generation; "but," he goes on to say, "do not let us "think that by paying money rather than the tribute of blood we are "doing anything praiseworthy. Productive industry is not the sole "source of the prosperity of a country; there are moral qualities de-"veloped in the training of a recruit which springing, as it were, from "the Army as a source, permeate through the lower strata of society, "and add largely to those qualities which make up the greatness of a "nation." In this pregnant sentence, the noble veteran clearly indicates the real character of the motives and influences which make us prefer voluntary to compulsory military service, and which are so powerful as to render conscription in any form practically impossible in England. Why should economical considerations be considered paramount? Is it good for a nation that these interests should always prevail? Are not the interests of industry selfish interests? The private individual interests of the manufacturer, of the merchant, of the shopkeeper, always distinct from the interest of the State, sometimes contrary to them. These men shrink from the idea of being personally liable to military service; they shrink from any sacrifice of private interest to public duty. Their object is so to shape the policy of the State as to make it subservient to their own private interests. They repudiate or evade the obligation of sacrificing these interests for any object in which they have no immediate concern, however essential that object may be to the welfare of the nation and to the preservation of the virtues of the people. But was it acquiescence in such demands that made Greece great, or Rome great, or Prussia great, that, in the recent great American contest, gave victory to the North and glory to the South?

It may not be necessary, and if not necessary, it may not be politic to exact from Englishmen that tribute of compulsory military service which Prussians and Frenchmen are obliged to render; but it is certainly not merely politic, it is infinitely important, so to frame our institutions and so to conduct the government of the country, that every man among us may feel the obligation to sacrifice his own individual interests for those of the State.

Freedom from conscription is an advantage dearly purchased, if it cause the spirit of patriotism to decay, if it tend to strengthen the power of selfish motives, or to weaken the influence of the obligations of duty, if this immunity exists, because our statesmen believe that material prosperity should be the chief object of the exertions of individuals, and of the policy of the nation.

These are the considerations which in my opinion render a suggestion of Colonel Baker's well worthy of the attention of statesmen. He proposes to draw by lot from the population, 500,000 men, to be inscribed in a list, from which at any time when required, men might be drafted by a second ballot, to fill up vacancies in the ranks of the Militia. Under such a system, in the present state of our foreign relations, the liability of any individual to render compulsory service would, if calculated by an actuary, be found to be merely nominal. Without therefore inflicting any appreciable injury on individual interests, it would be possible, by adopting this scheme, practically to apply the principle of conscription to the constitution of our military forces. Lord Elcho, although he has not, so far as I am aware, pronounced any opinion concerning Colonel Baker's suggestion, has spoken very decidedly and forcibly in favour of its principle. He wishes that something more should be done than merely to retain in the statute-book the power to ballot. He thinks this power should be actually exercised, and that every year a certain number of men should be selected for the militia by ballot, just to keep the people in mind that military service is one of the obligations of every citizen.

God forbid that a great national disaster, or even that any formidable national danger should ever force us to adopt conscription as a necessity. Nevertheless, of two evils, it is better that a nation should occasionally suffer the calamities of war than that, during a long period of peace and prosperity, the spirit of selfishness should gain strength, and the spirit of self-sacrifice and obedience to the obligations of duty should decay.

While, therefore, I admit that, on the grounds of expediency, we must accept the principle of voluntary enlistment as the basis of the constitution of our military forces, I think that any statesman who undertakes to re-model our military institutions, should attentively consider the moral and political advantages to be derived from adopting some such suggestion as that of Colonel Baker, for recognising and giving practical effect to the principle of compulsory service.

The next point to be discussed, is "the duration of the military engagement." The weight both of argument and of authority is clearly in favour of a short term of service. Sir Charles Trevelyan's numerous admirable writings clearly demonstrate the moral advantages of a short term of enlistment, and the most able and interesting paper lately read in this Institution by Lieutenant-Colonel Leahy, demonstrates with equal, or rather let me say (since his conclusions are supported by irrefragable arithmetical calculations) with still greater cogency, its economical advantages. It is true that Lieut.-Colonel Bannatyne, who has discussed this question with his usual ability, is in favour of a long term of service. He feels strongly as a practical soldier, the difficulty of

adapting the arrangements necessary for filling vacancies in the ranks of our great Indian Army, to a short period of enlistment. But Colonel Bannatyne's pamphlet is dated 1867. At that time Colonel Leahy's paper had not been read, and Sir Charles Trevelyan's criticisms and suggestions had not been published. I shall therefore pass over the objections to short terms of service, which have been very ably stated by Colonel Bannatyne. I do so, not because I consider them unfounded, or even unimportant: I admit both their reality and their importance; but the advantages of short terms, as stated by Sir Charles Trevelyan and Lieutenant-Colonel Leahy, appear to me very much to exceed the disadvantages, as stated by Lieutenant-Colonel Bannatyne; and this seems a sufficient reason for declining to discuss an opinion formed before Colonel Leahy had spoken, or Sir C. Trevelyan had written. But there is another Officer who, although it is to be presumed that he is cognisant of all that has been said on the subject by Sir Charles Trevelyan and Lieutenant-Colonel Leahy, still maintains the same opinion as Lieutenant-Colonel Bannatyne. Sir Archibald Alison is now publishing in a separate form, two articles on "Military Organization," originally contributed by him to *Blackwood's Magazine*. The work is still in the press, but I have been favoured with a copy of the proofs, and I presume many gentlemen here present are familiar with Sir Archibald's views, as stated in the pages of *Blackwood*. I should think many of those I am addressing must, like myself, have felt astonished when they found so able and well informed an Officer arguing in favour of the expediency of long enlistments. I have a great respect for his opinion, and have read his statements and arguments very carefully. He quotes the great names of Napoleon and Wellington as conclusive authorities concerning the value of old soldiers. But if Sir Archibald will read carefully what General Trochu says about *le jeune* and *le vieux soldat*, he will learn to avoid the fallacy of confounding an old soldier and an old man. He will learn to avoid deceiving himself and his readers by quoting words spoken of young men in time of war, who had served two or three campaigns, as if they proved the expediency of binding men to serve in time of peace for 20 years in the ranks.

Both the weight of authority and the force of argument are so unequivocally in favour of short enlistments that, although Lord Northbrook did not speak very decidedly on the subject, it seems extremely probable that the thing will be tried.

The Duke of Cambridge suggests a safe mode of doing this. He says (what I think even the most sanguine promoters of the new system must feel to be true), "It is impossible for any one to "feel sure if a short term of service will take with the country, if, "under our voluntary system, it will prove sufficiently popular to secure "as many recruits as are wanted; therefore, (says His Royal Highness), "let the two systems be tried concurrently; let recruits have the option "of enlisting either for a long or short period, as suits them best."

We have a corps of Guards about 6,000 strong. These troops not being liable to take their tour of foreign service, might be enlisted for a short term without inconvenience. The only thing to be considered would be, what is the most advantageous arrangement for the

performance of home duties. Suppose that the total engagement was for seven years, and that the conditions of service during this period were so arranged that each recruit enlisted should pass one year at a depôt, two in the ranks, and four in the reserve. Under this arrangement one-third of the force, or 2,000 men, would annually pass into the reserve, and at the end of seven years we should have 2,000 at the depôt, 4,000 in the ranks, and 8,000 in the reserve, being a total of 2,000 recruits and 12,000 trained soldiers.

As regards the interests of the State, the advantages of a short military engagement are numerous and indisputable. But as regards the interests of the recruit, I do not agree with Sir Charles Trevelyan in thinking that the effect of reducing the duration of the engagement would be to render the service more attractive. As the Army is at present constituted, one of the chief inducements which attracts recruits, is the certainty of a life-long occupation and of a provision for old age. Colonel Leahy has pointed out that the statistics of re-engagements clearly establish the fact, that the motive that induces the great majority of recruits to enlist, is the desire to obtain permanent employment; and although it is true that there are at all times in the ranks of the Army a great many soldiers who are discontented with the service, and who desire to leave it, yet this does not by any means prove, that at the time of their enlistment even these men would have considered it an advantage, if the conditions of their engagement had been such, that military service, instead of being a permanent employment, had been merely a temporary occupation for a specific term of years. It, however, deserves to be noted, that the adoption of a system restricting the period of military service to a short term of years does not by any means prevent the desire of obtaining permanent employment continuing to operate as a motive of enlistment. Under such a system, of course all non-commissioned Officers, and probably also a certain proportion of picked privates, would be permitted to re-engage. Although, therefore, only a small number of those who enlisted would actually obtain the advantage of a second engagement, yet the hope of obtaining it would be common to all, and I think it quite possible that this hope might, in many individual instances, practically have almost as powerful an influence in inducing a recruit to enlist, as the certainty of obtaining a permanent life-long occupation conferred by the present conditions of enlistment.

If, however, an advantage which was formerly offered to all who applied for it and secured by contract, be made contingent on good conduct, and if it can only be obtained by one out of many competitors, it is evident that the value of that advantage measured, not by its effect on individual minds, but by its effect on the general labour-market, must be diminished; and if the same number of labourers are required we must offer some equivalent to make up for this diminution of value. Since then the effect of a change of system which will convert military service from a permanent employment into a temporary occupation, must necessarily be to render it less attractive, and since also the number of recruits required, increases in the same proportion as the term of service is shortened, it will evidently be impossible to keep

our military establishment complete, unless some advantage is offered to soldiers which is at least equivalent to the difference in value between an offer of permanent and an offer of temporary employment.

Sir Charles Trevelyan's proposal to make military service a condition of obtaining civil employment would, if adopted, no doubt give Government a very extensive command of the labour-market, and prove a most effective means of obtaining recruits. His proposal merely refers to the lower branches of the civil service, but, both on the ground of abstract principle and of practical expediency, I think that military service of some kind should be exacted from those who seek the higher, as well as from those who seek the subordinate appointments. The treasury clerk might be selected from young gentlemen who have held commissions in a Militia regiment, or served in a Volunteer corps. Policemen and letter-carriers from soldiers who have served in regiments of the line.

To establish a connection of this kind between the military and civil services would be a benefit to both. The effect on the military service would be to attract recruits and to act as an incentive to good conduct, on the civil service to diminish the evils which spring from the abuse of patronage. I do not, however, feel at all sure that such a measure as that proposed by Sir Charles Trevelyan would of itself be sufficient to attract a supply of recruits adequate to the increased demand that would be caused by shortening the term of service. I think it would very probably be also found necessary, as suggested by Lord Elcho, to offer to soldiers, for three or four years after their discharge from the Line and transfer to the Reserve, a reduced rate of pay, say sixpence or fourpence per diem.

The next question to be discussed is that of "organization." In this respect our military institutions are singularly defective. It is admitted that we have no organization beyond that of the regiment; there is no unity of command, no machinery for the exercise of an efficient supervision and control. The Militia, the Volunteers, and the Line are each independent of the other, and quite destitute of any systematic arrangements for ensuring their combined action. The remedy for this state of things is completely in the power of the Government.

In devising a scheme of enlistment, Her Majesty's Ministers cannot calculate with certainty on the effect of the measures they adopt. They know that such and such measures will be advantageous to the State, but they cannot tell how they will affect the private interests of individuals, and unless these private interests are in accord with the public interests, recruits will not accept the terms they offer, and their measures will fail. But as soon as the men are enlisted, the manner in which they are organized is a matter which a Minister can deal with as he pleases.

Lord Northbrook has informed us that the Government have resolved to deal with this question, and that measures will be adopted for ensuring unity of command, effective control, and combined action of all our military forces.*

* *Times*, April 24, 1869.

Much difference of opinion exists as to the manner in which a Reserve of discharged soldiers should be constituted, and as to the manner in which the Militia should be connected with the Line. Sir Charles Trevelyan advocates the incorporation of the Line and Militia in composite regiments having a common depôt, and he thinks discharged soldiers should be transferred to the Militia. Colonel Leahy thinks the Militia and Line should, as at present, be entirely distinct in their organization, and that soldiers transferred to the Reserve should continue to be borne on the establishment of regiments of the Line. Colonel Bannatyne agrees with Colonel Leahy in thinking that the Militia and the Line should be kept distinct, although he admits that their regimental incorporation would be a simpler organization.

One of the most important questions connected with the subject of organization relates to the promotion and appointment of Officers. Although I have made a special study of this question, yet I feel considerable hesitation and reluctance in stating my opinions concerning it, because I regret much, that as regards this question, they are completely at variance with those of Sir Charles Trevelyan. I know, however, that Sir Charles is no less distinguished for the soundness and perspicacity than for the candour and judicial impartiality of his judgment; I trust therefore, that though others may accuse me of presumption, Sir Charles himself will not look upon me as an advocate unduly confident in his own convictions, and asserting in an unbecoming manner that a distinguished opponent is mistaken, but that he will rather regard me as a witness anxious to give evidence before a distinguished judge on a subject respecting which the witness has had some special opportunities of acquiring information. Nor is it only my own testimony for which I solicit consideration, but for that also of Colonel Baker, of Colonel Bannatyne, and last, but not least, for that of the writer of the article in *St. Paul's Magazine* of last April, who signs himself a "Private Dragoon."

Colonel Baker, who has had much experience of foreign armies, who has not only had much intercourse with the Officers serving in those armies, but also with many of the chiefs who commanded them, is surely well qualified to form a correct judgment as to the value of British Officers as compared with those of foreign armies. He says, for the command of men, the material of the British army is much better than that of any foreign army, and whatever shortcomings and deficiencies exist in the way in which British Officers perform their duties, arise from the faults of our system and from the defective way in which the material is worked up. I have no pretension to speak with the same authority as Colonel Baker. My opportunities of observation have been much fewer than his. I have, however, on several occasions seen foreign troops, and associated with foreign Officers. So recently as last year I paid a visit to the camp at Chalons, and had the advantage of a letter of introduction to the Chief of the Staff, and I am anxious to state that the impression made on my mind by what I have seen of foreign Officers, and by what I know of our own Officers, has led me to form the same estimate of their relative value as that formed by Colonel Baker.

As regards character and capacity, as regards all those moral and social endowments which confer influence and qualify for command, there is no army in the world which possesses a finer body of Officers than the British, nor do I think there is any preliminary training more suitable for the formation of Officers than that which is given at an English public school. If British Officers are sometimes ignorant of their duties, if they sometimes perform them carelessly, the defect is in the system, not in the men. The true remedy is not to change the men, but to improve the system. It is a better system, not better men, which is required; but if we wanted better men, we certainly should not get them from the ranks. To foster and develope those qualities which are required to make an efficient Officer, no training is more unsuitable than that received by a soldier serving in the ranks, none more suitable than that received by a boy at any of our great public schools. The article in *St. Paul's Magazine* ought to be read carefully; the testimony of the writer as to facts is unimpeachable, and as regards the inferences he draws from the facts he states, it appears to me that his arguments are unanswerable, and his manner of stating them quite inimitable.

The CHAIRMAN: Would you pardon me; I do not know whether you have exhausted your subject?

Colonel ROBERTSON: By no means.

The CHAIRMAN: The rule of the Institution is, that the lecturer should confine himself to an hour, with a view to discussion following. I see that it is now half-past nine. I am obliged to remind you of the rule.

Colonel ROBERTSON: I shall find it utterly impossible to say all that I wish to say within that time. Seeing how little time remains, I think I shall do well to take your hint; but it is difficult to compress a very large subject into a few words.. As I before stated, I did not originally intend, when I first communicated with the Committee concerning the subject of this night's discussion, to offer any suggestions of my own. My original intention was merely to attempt to classify the suggestions of others. But on reviewing all that had been said and written respecting the selection and promotion of Officers, it appeared to me that although the present arrangements for the appointment and promotion of Officers of Militia regiments are exceedingly defective and unsatisfactory, nevertheless this subject had not received that amount of consideration which its great importance deserved. I have therefore thought it might be useful to submit for discussion certain suggestions for the improvement of these arrangements. If I read over these suggestions, make a few brief comments on them, and then conclude, I hope this will meet your wish.

The CHAIRMAN: I can only tell you what the rule is, and leave it to the meeting.

Colonel ROBERTSON: The following are the suggestions which I am desirous of submitting for the consideration of the meeting:—

I. That the tenure of command of a regiment of the line should, like that of a staff appointment, be limited to a fixed term of years (say five, six, or seven), at the expiration of which, the Colonel should retire on the full pay of his rank.

II. That the command of regiments of Militia should be conferred—

a. On Colonels placed on full pay at the expiration of a term of five years in command of a regiment of the line.

b. On any field Officer of the line desirous of being placed on half-pay, conditionally on his undertaking to perform this duty.

III. That no Officer should be allowed to hold the appointment of Adjutant of a regiment of Militia, or of a Volunteer corps, for a longer period than three, or at the most five years.

IV. That Officers should be selected for these appointments from unmarried Captains of regiments of the Line, a preference being given to those who had formerly been Adjutants.

V. That during peace, the appointment of subalterns to regiments of Militia be discontinued, and during the annual training, their duties be performed by subalterns detached from regiments of the line.

The 1st of these suggestions has been already made by Sir A. Alison, and also, I think, by Lieut.-Colonel Leahy.

Lieut.-Colonel LEAHY: I said the Colonel on the Staff should be made a higher rank than it is at present.

Colonel ROBERTSON: To prove the utility of the suggestion, I submit the following reasons:—In time of peace, the principal and most useful function of an Army is to serve as a school of instruction. As soon, therefore, as an Officer has commanded a regiment for a sufficient time to obtain a thorough practical knowledge of the duties of this important office, it is desirable that he should be removed, so as to afford the same opportunities for perfecting the regimental training of another Officer. The object of our arrangements should be, in a given term of years to train as great a number of Commanding Officers as is consistent with the efficient training of each individual Officer included n that number. Of course this suggestion is only applicable to a period of peace. In time of war, the interests of the public require that the duration of the tenure of the command of a regiment should be regulated by the capacity of performing efficiently the duties of a Commanding Officer. The longer a good Officer holds his appointment, the better for the public; but in time of peace, precisely the reverse of this is the case. The better the Officer, the shorter should be his term of command. As soon as he has thoroughly learned his work he should be removed, to give an opportunity for training the next in succession.

An OFFICER: What about his money?

Colonel ROBERTSON: Of course he must have compensation. I have thought about the best manner of giving it, but I cannot go into this question at present. It is a matter of detail. I have, however, stated in my 2nd suggestion how I think Colonels should be employed during the interval between their completion of the prescribed term of Regimental command, and their promotion to a vacancy on a fixed establishment of Major-Generals. I think it will be admitted that during this interval no more suitable employment could be found for a Colonel than the command of a Militia regiment, and it is also obvious, that for Militia regiments, no more efficient Commanding Officers could be found than Colonels thoroughly trained to their work by at least five years' experience in a regiment of the line.

Taken by itself, my first suggestion might be represented as equivalent to a proposal to cut short the career of an Officer and to deprive the State of his services at the very moment when his training had been completed, and when his value as an accomplished public servant had reached its maximum. But taken in connection with the second suggestion, my proposal really is to increase the supply of thoroughly trained Commanding Officers, and to assign to every Officer so trained, a duty which, without such training, cannot be efficiently performed.

The utility of my 3rd and 4th suggestions, is so obvious that they scarcely require any comment. By making Militia and Volunteer Adjutancies, Staff appointments, and restricting their tenure to a short term of years, we should effectually suppress the scandalous traffic in these appointments, which the imposition of a stringent declaration has utterly failed to check. This measure would also put an end to the flagrant abuse of allowing these important appointments to be held by men of advanced age, who take little interest in their work, and are not capable of performing their duties properly. I met at Aldershot last year a Militia Adjutant, under whom, more than twenty years before, I had served as a subaltern. He was then a very able Officer, and is so still, but what interest could he feel in the performance of subordinate duties when brought into contact with Officers formerly junior to him, now in command of Regiments and Brigades?

I look upon a young and zealous adjutant as no less essential to the sound constitution of a Militia regiment than an experienced and thoroughly efficient Commanding Officer. If an appointment be sought as a means of procuring experience and distinction, and as a stepping-stone to further advancement, its duties will be performed in a very different manner than if it be sought, I will not say as a sinecure, but as an eligible retirement, for which past merits will be accepted as a valid claim, and no promise of future exertions required.

I come now to my 5th suggestion. Under the existing system it is obvious that we cannot get subalterns for Militia regiments. Moreover, if we could get them, until sufficiently instructed to take command of a company, subalterns would be of no use. This amount of instruction could not be given them during a few weeks of training. Subalterns in a Militia regiment would, therefore, add nothing to its efficiency; they would be like apprentices bound to a master, without a shop, without tools, without any apparatus for affording them the practice necessary to acquire skill in his craft. Under the present system of short annual training, the only practicable means of obtaining the assistance of properly instructed subalterns, of subalterns who have finished their apprenticeship, and are sufficiently instructed to be employed as journeymen, is *to borrow them from the line*. One effective Officer per company is perfectly sufficient for training purposes, so that only three or four subalterns per battalion would be required in order to provide for occasional absence and casualties among the Captains. The duty would probably prove more interesting to the subalterns employed, than the ordinary routine of regimental work, and if zealously performed, would certainly be very instructive to them.

In a leading article of the *Times* of 1st May it is said that if 140,000 thoroughly good soldiers could be put in the field at a week's notice, no Army competent to face them would be likely to reach these shores. Those who believe that to be true, must, I think, accept the inference drawn by the *Times*, that if every regiment of Militia could be so constituted and trained as to render it as effective as a battalion of the line, the first and most immediate problem of Army reform would be solved. The writer in the *Times* admits that, to establish a Militia 140,000 strong, as well officered, as well equipped, as well trained, and as well organized as soldiers of the regular Army, would be no easy matter; but I agree with him in thinking that if the Government and the nation were convinced that this was the first result to be secured, its accomplishment would not be far off. The first and most important step towards the accomplishment of such a result would undoubtedly be to secure for each Militia regiment a thoroughly efficient corps of Officers, and this, I venture to think, would be effectually and easily done by the adoption of my suggestions.

There is an opinion of Sir Charles Trevelyan's, respecting which I am anxious to offer a few observations. Sir Charles thinks that you cannot expect to get any good service out of an Officer unless he is well paid, and that gratuitous service is generally bad service. Sir Charles has not stated what grounds he has for holding this opinion, which seems neither consistent with actual experience nor with a correct appreciation of the power of pecuniary motives, as compared with the power of other motives to exertion. In all recent wars, among those Officers who have most distinguished themselves for their intelligence, their gallantry, and their zealous devotion to their duties, there has always been a fair proportion of Officers possessing sufficient means to render them independent of their pay, and who have invested in the purchase of promotion, sums so large that the interest of the money invested, would have been equivalent to the pay of the promotion purchased. It is, therefore, no exaggeration to say, that in the Guards and Cavalry there are many Officers who serve for nothing. Has it ever been found that Cavalry Officers and Officers of the Guards are inferior in courage, in intelligence, in zeal, to Officers of Infantry regiments? Does not Sir Charles believe, that no work is really first-rate unless the workman feels a pleasure in it, and is more influenced by the ambition of excellence than by the desire of profit. Why then should he think that Officers cannot be depended on to do their duty properly unless they are highly paid?

Sir CHARLES TREVELYAN: What of those who have not the means of serving for nothing?

Colonel ROBERTSON: There are, of course, many poor men who would make excellent Officers, but who are deterred from entering the Army because the pay is small, and the style of living, expensive. But there is an abundant supply of Officers who are able and willing to perform their duties for the present rates of pay, and I do not see any reason to suppose that duty would be better done if the rates were raised. On the contrary, I feel quite certain, that it would be worse done supposing the pay was high and the Army principally officered by men whose

chief object in seeking for commissions, was to realize a good income. In time of war, a rich man who prefers a life of risks and hardships to a life of ease and pleasure, proves that his heart is in his work. The presumption is that he will prove a good Officer. In time of peace a poor man, who accepts a low rate of pay, who practises great self-denial, and submits to many mortifications for the sake of obtaining military rank, also proves that his heart is in his work. Thus, whatever may be the disadvantages of the present constitution of the Army, that constitution has at least this advantage, that the terms of his service necessarily establish a presumption, that every Officer who accepts a commission, whether he be a rich man or a poor man, feels an interest in military duties, and has his heart in his work.

The CHAIRMAN: In inviting discussion I must remind you of the rule laid down by the Council, that each gentleman is allowed ten minutes.

Colonel OUVRY: I should like to make a remark upon that last observation of Colonel Robertson, concerning the "Officer who serves for nothing, who is so rich that he is able to serve for nothing, and that he makes a better Officer than others." I ask any person who has had experience of what happened in the Crimea, or in India, whether those Officers who are possessed of much money are the best Officers, whether they do not always fall off in times of trouble, and whether it is ever possible to get Officers who have money to continue to serve under circumstances of hardship and difficulty? I say they never will serve, you cannot depend upon Officers of that sort. If we had to fight a battle in Hyde Park we should never get more gallant Officers, but when they have to face hardships, with no fighting, no delicate food, no comforts, we know that generally speaking, after they learn what the discomforts and privations of war are, they apply for leave, and if that is refused, they request to sell out. I ask any person who knows anything of the past whether numbers of Officers did not do so, both in the Indian mutiny and in the Crimea? and also whether in the French army, large bodies of Officers ever send in their resignations, or send in applications to leave the army in time of war? Again, I ask those who know anything about the affairs of the Peninsular war, who were the Officers who fought and conquered in that war? Were they men of large fortunes? I recollect having a conversation with one old Captain; he told me he was tried as to whether he was a gentleman. After that war was over, a great number of Officers were brought before a committee and were questioned. They asked them "Who is your father? where does he live? what is he?" There may be Officers in this room who remember the facts, but I say, speaking from my own personal knowledge of what happened in the Crimea and in the Indian mutiny, I know that what I say is true. Officers will rush in at first, but if the war continues, you will not be able to get one. It is always the case. I have two relations, who were in the Peninsula, they were both put on half-pay after the war was over. They both of them got cadetships, and one rose high up in the service of the East India Company. I say if these men had been men of large fortunes, would they have gone into the Indian service? Certainly not. The question is whether you are to have an aristocratic or a popular army. I say that all these papers and pamphlets which we have read lately, have some excellent things in them; no doubt, the pamphlets of Sir Charles Trevelyan are most excellent, but the great mass of them go no further than tinkering and patching up. What we want is a thorough reform, and that reform is simply to popularize the Army; that is my idea of the subject.

An OFFICER: How would you popularize the Army?

Colonel OUVRY: I would do away with the purchase system, and I would thus popularize its ranks.

Sir CHARLES TREVELYAN: I am sure that we must all feel our obligation to Colonel Cunningham Robertson for the assistance he has given at the present stage of this great national controversy. While Parliament is officially discussing the Irish Church, people are thinking a great deal more about the Army, and are only

waiting till the Irish Church is got out of the way to enter upon the practical settlement of the question. In the present stage of the discussion, Colonel Robertson has performed a useful public service by comparing, with great industry and skill, all the proposals which have been made on the subject. He has not had time to tell us the whole that he had prepared, but I hope he will give it to us in print, so that we may read it at our leisure. I will only touch upon two or three of the points alluded to by him.

I do not think Colonel Robertson fully appreciates the real objection to conscription. What took place at the commencement of this century furnishes the solution of the question. When we were threatened with invasion from Boulogne, it was universally considered necessary to have, what was called in the language of the day, a levy *en masse*. The whole able-bodied force of the country was to be organized. The enrolment actually took place, parish by parish, but in the meantime it was considered desirable to try what could be done by volunteering. So, more as a supplementary arrangement than for any other purpose, Volunteers were called for, and they came forward in such great numbers, amounting soon to two, three, four hundred thousand, that the levy *en masse* was set aside, and was no more thought of. The public sentiment entirely accepts the principle that every man's service is due to his country when it is really wanted. But this is a highly organized country in an industrial point of view. Our financial, commercial, and manufacturing system is of a very complex character, and, on the simplest principle of the division of labour, it is best for all parties that those who are so circumstanced that they can easily leave home, and give themselves up to the defence of the country, should do so, and that those who are occupied in carrying on the business of the country should remain at their desks, and in their manufactories. Conceive what the result would be if the 500,000 conscripts proposed by Colonel Robertson to be enrolled, were actually called out. Who would they be? They would be taken from the public offices, railways, telegraphs, manufactories, from industrial establishments of all sorts, their withdrawal from which would throw the social and political system of the country into utter confusion. It is far better that the whole country should unite in paying whatever may be necessary to send to the front that portion of the youth of the country which can best be spared from carrying on the ordinary business of the country.

Next, I am surprised to hear Colonel Robertson object to educated, intelligent soldiers. In order to get the requisite number of soldiers, we must draw upon the educated classes. Happily for our country and for its prospects, the uneducated, reckless classes from which we have hitherto drawn our soldiers, are becoming scarce, they are becoming totally insufficient to meet the demand. So, quite irrespective of the question whether educated or uneducated men make the best soldiers, it is positively necessary, in order to get the requisite number of soldiers, that we should call to our aid the classes who have been educated in national schools, and who form the bulk of our agricultural labourers, artisans, manufacturers, as well as of the persons employed in the police, on the railways, and in various other occupations of that sort. And in order to attract these great classes, which are far more numerous than those which now fill the ranks of the Army, we must make the Army a career for them, and furnish them with adequate motives. That educated, intelligent men, like our Volunteers, are more easily disciplined and handled than uncultivated clowns, and are animated by more patriotic feelings will, I am sure, be admitted.

Colonel Robertson justly pointed to the Militia as the key to our system of national defence, and the public sentiment is settling upon this basis. Now, there are two great defects in our Militia system. The majority of the gentlemen now present are better able to judge than I am, yet I believe I am speaking the truth when I say that the great defect of our Militia is, that they are not sufficiently trained. The twenty-one days' training in each year, with the few additional days for drilling the recruits, are totally insufficient. If it is repeated year after year for twenty years, it still fails to turn out a properly trained soldier. And if this has been so hitherto, how much more now, owing to the introduction of arms of precision and rapidity, and the improvements in the exercise and manœuvres of troops—trenching—loose order, and so forth, all which require careful, continuous instruction. The twenty-

one days' training are now quite insufficient. Therefore, I propose that the whole of the regular Army,—Militia, as well as Line,—should go through at least one complete year's training.

The other great defect is, that the Militia is not connected in any proper relation, with the other forces of the country. From the Volunteers, of course, it is entirely separated. Even as regards the line, with which it has more in common, professing to be of the same character, yet the two forces, the Militia and the Line, are at present rival forces. They compete against each other in the recruiting market; and when the Militia is called upon to serve as a reserve to the Line, it is only by weakening the Militia and furnishing trained men, against the grain of the Commanding and other Officers, that it can be done. For this and other reasons, which have been fully explained in my recent pamphlets, I would combine the Militia with the Line in a regimental organization, so that they should be localized and united, by making the regiment of the Line, which is most connected with the district, and the local militia regiment, and also in a secondary degree, the local Volunteer regiments, battalions of the same regiments; having at the head-quarters of each district, a depôt battalion common to all, which should train the recruits both for the Militia and for the Line. I would make the first engagement always for one year; and at the end of the year, the young soldier should have his choice of returning to civil life, with a ten years' engagement in the Militia, to come out for a few days, now and then, for divisional manœuvres, or of joining the Line or general-service battalion of the regiment, with a seven years' engagement, returning at the end of that time to the Militia for a further period of ten years. In this way there would be only one machinery for supplying trained recruits to both Line and Militia, and the two forces would be combined in one organization.

But the main point of all, and the only remaining one upon which I will make any observations, is, whether, according to this system, we can get a sufficient number of recruits. In order to get recruits on the one year's engagement, I rely upon the general popularity of the military service, and upon the prestige of the military character. The young men would come at an early age, for even at the age of 18, our young men are quite old enough to be trained; and they would engage, knowing that at the end of the year, if they did not like the Army, they could return to civil life. But at the year's end the great difficulty would have been got over. As Baron Dupin observed, "the difficulty is not to induce a soldier to remain when you have once "trained him, but to detach him in the first instance from his home and home asso-"ciations." Therefore, I would make the first stage of the military career very short and easy. And I believe that the spirit which brings an unlimited number of young men into the Volunteers would, to a great extent, be diverted into this channel.

The military spirit of the country now finds its vent in the Volunteering system. I believe that if a system such as I have sketched, were established, the same spirit would bring large numbers of young men into the Depôt Battalions at the County towns. It would not be a strange community into which they would be introduced. On the contrary, the local Depôt Battalion would be filled with their own relations and friends. It would also be filled with men who had seen foreign service, and were holding comfortable and respectable positions in the depôt battalion as instructors. The young men would also have before them the example of numerous persons from the neighbourhood, and probably from their own village, and from among their own relations, who had risen to respectable positions, both in the military and civil service. As Colonel Robertson has remarked, seven years' general service at home and abroad, the performance of this share of hard national service, should entitle men to some positive advantages. First of all, there would be the advantage of returning to the *cadre* of the regiment, the depôt battalion, and becoming instructors to the regiment. Then, there would be, according to my view—I will not now enter upon the argument, except to say that military promotion must always be taken in connection with the new motives by which new and better educated classes are proposed to be attracted into the Army—a certain fixed proportion of military commissions in each regiment appropriated to the most deserving and best qualified of the young men. But, above all, the whole of our great Civil Service should be

thrown open to the extent to which the men might qualify themselves for it. That element alone would accomplish the object. If our Customs, Excise, Post-office, Police, and all the other departments, were thrown into the scale, that alone would make the Army a popular profession.

Captain VAUGHAN: Would Colonel Robertson kindly allow me to put a question with regard to appointing subalterns from the line to fill the place of subalterns in the Militia? The Captains would remain in the Militia as at present, and no more subalterns would be appointed, but subalterns would be sent from the Line?

Colonel ROBERTSON: Only for the training for a month.

Captain VAUGHAN: The question I wish to put upon that is, would you offer an inducement to these Officers to go to the Militia, or would you order them to go?

Colonel ROBERTSON: I would order them to go. If there was any little expense incurred in moving, I would pay for that, but I would order them to go.

Captain VAUGHAN: I was inclined to dispute that part of the question.

Colonel ROBERTSON: I would not put them to that expense.

Captain VAUGHAN: But I think very few subalterns from the Army would be willing to serve under Officers of far less experience than themselves, as the Captains of Militia would be. There is one more point I would allude to, in fact two points. One is that the Militia, during the Crimean war and elsewhere, were insufficient to fill up the battalions of the Line, or be of any use beyond garrisoning the Mediterranean stations. As proof of that I may adduce the fact, that at that time we were obliged to recruit for mercenaries throughout Germany. There is another grand objection to the Militia, and that is, it is liable for service in England only, and not for service abroad.

Lieutenant-General LORD TEMPLETOWN: On the question of conscription I wish to say a very few words. I do not agree with the Officer who has addressed us this evening, nor do I disagree with him. But to explain myself, I will say that for a defensive army I would have conscription, but not for an Army of action out of the country. I should hardly have thought it worth while to address you upon this subject, had I not rather strong authority. I may say with Horace,—*Non meus hic sermo est.* But my preceptor was no ignoble one, for the opinion which I have just given you I heard from a personage whose loss we all deeply regret, and whose character we all highly value. I mean the late Prince Consort. I was in attendance upon him on duty once at Aldershot, and had the honour of accompanying him in his ride; and his Royal Highness made that remark which I thought most valuable:—I think the country may well demand of every patriotic man his services in case his country is attacked, and I think it might be carried out by conscription; but as to the general services of the Army in our colonies and elsewhere, although they uphold and carry forward the honour of our country, yet I do not think the conscription is so essential in that respect. I am quite sure you will think it worth while that I should have communicated to you this opinion, which must have value in your judgment of the matter under discussion.

Colonel ROBERTSON: Lord Elcho and Colonel Baker only advocate conscription for the defensive army, the same as Prince Albert. It is merely the principle they want to establish.

Lieutenant-Colonel LEAHY, R.E.: I will first refer to what Lord Templetown has just said as conveying the views of Prince Albert; with respect thereto, I would observe that I do not think it would be found in the history of this kingdom, that the people of England have ever failed to come forward for the defence of the nation against invasion. The difficulty in recruiting our forces has arisen in respect of our offensive and colonial Army, and not of our defensive Army. I think, therefore, with Colonel Robertson and others, that conscription may be set aside as a necessary part of our organization. Nobody proposes it for the offensive Army, and for the defensive Army, we do not want it. I, therefore, consider that any scheme of organization should be based upon the volunteer system.

There is another part of our military system, which, so far as I know, has never failed; that is the regimental system. I therefore think that in plans for the organization of our offensive forces, we should adhere to the regimental system, and attempt to expand it. I think the manner in which we now fail is, that we have got

regimental *cadres*, varying in strength from 500 to 1,000 men, the number of men being altered according to the views of the Cabinet of the day, but we have no machinery, or men in reserve, and easily made available to raise the regiments to their maximum strength. I think that these reserves ought to be under the control of the Commander-in-Chief, as distinguished from the civil control, to which the Militia and Volunteers are subject. I have felt great diffidence in giving opinions on this subject, but struck by the admirable arguments of Lord Grey before the Recruiting Commission, I could not help putting forward (early in 1867), the details of a system by which I thought the reserves of the offensive forces might be tacked on to the present regiments. I think there are many reasons in favour of this plan. My reason for not proposing to attach regiments of the Line to regiments of Militia, was that the Recruiting Commissioners reported that it would not be "a desirable or expedient course" to localize regiments. I do not now see how you are to carry out the localization of regiments, especially in the case of regiments recruited in Ireland, and in the present mood of that country. I think our system ought to provide for establishing local connections, without localizing regiments. One of the advantages of the system which I proposed is, that regiments could have local connections in different parts of the country without being necessarily quartered in these localities for any length of time.

I now pass to the question of length of service. We want to get more men, and I think it is admitted by all that short service is the way by which we are to get more men, and that by means of short service we shall popularize the military service, and have a larger proportion of men trained to arms. That the proposition is economical I have attempted to prove in my paper, and I do not think the calculations have been controverted. A short service man, when you take into consideration the pension, costs half of what a long service man does. I do not advocate the payment of bounty, but as a matter of economy it would be cheaper to pay a short service man £200 bounty, than to re-engage an old soldier. That is the financial view of the question.

An Officer: Particularly if he deserted next day.

Colonel Leahy: I do not suppose either to desert. I entirely agree with what Sir Charles Trevelyan has now said, that the first stage must be made very short and very easy; anything that lengthens the term of enlistment beyond what is necessary for training, will destroy the benefit of the system of short service. Seven years is neither one thing nor the other. In enlisting the soldier I would give him every facility for returning to civil life, subject to service in the reserves. All we should require is, that he should serve continuously until he qualifies as a soldier. And even that I would not insist upon, if, as in Prussia, he was allowed to pay his own way. In the Prussian service, young men may volunteer to serve for one year without pay, and at the end of that year, they may go. I would introduce the same system. If a man wished to go after one year, and paid his expenses, I would let him do so.

If a soldier wished to stay after the short-service period, and was required for service abroad, or for colonial service (the length of that colonial service in my opinion is more a medical question than any other, and depends on the number of years for which men can serve, without special detriment to health, in the climate to which they are detached; in India this, I believe, is from seven to ten years), I would add the period of colonial on to the first period of service, and thus make up the long service. After that, I would make continuance in the Army dependent upon the utility and good conduct of the individual. I think the system of deferred pensions should also be kept up, because I do not think the vacancies in the civil service would afford sufficient inducement to service in the reserves. I would, therefore, hold out deferred pensions at the end of fifty or sixty years of age. I think you will have to retain some such inducement to get the number of reserve men you want. I would add a few words with regard to the article in the *Times* to-day. The writer gives people who have written on the subject of Army reform credit for having thought of it from one point of view. He says one person takes up fortification, another the Navy, another the organization of the forces. I think we ought not to get the credit of looking upon the subject from such small points of view. It is utterly im-

possible in a paper read in this Institution to take up everything, and, while dealing with one point, we ought not to get credit for having overlooked the others.

Captain COLOMB, R.M.A.: With your permission I will make a few remarks with reference to what has fallen from Colonel Leahy in connection with the paper before us. I allude to the question of localization and to the question of colonial service. Colonel Leahy has mentioned the fact that in a paper read in this Institution, it is impossible to go into the whole question of what is necessary to be done for our Fleets and Armies. Still, I think his remarks have a bearing upon the question of colonial service. One of the objections I gather from Colonel Leahy's observations is, that it is impossible to localize troops on account of the requirements of colonial service. After all it comes back to the question, what do you expect your Army to do for the colonies? If you expect your Army to hold all the British possessions abroad, well and good. Then, localization is impossible. But it appears to me that the colonies in time of peace have very little to do with the Army.

Colonel LEAHY: I did not put it upon that ground. I said you could not localize regiments in Ireland.

Captain COLOMB: I beg your pardon. It just shows the danger that we are liable to fall into by taking up too limited a part of the question. It appears to me that to consider and discuss the question of the organization of the Army off-hand, without first considering upon what that organization is to rest, is a mistake. I think it was Sir Charles Napier who said that success in war mainly depended upon two great principles; which were, "to be in the right place at the right time." Now, it is the business of distribution to determine what is "the right place," and it is the function of organization to secure "the right place" being filled "at the right time." Now, there are many representatives of particular schemes of organization in this room, and if we all gave our opinions we might agree in some things, and we might disagree in others. But I believe the key of the whole question of military organization rests really upon a question of distribution. Any person who disputes Sir Charles Trevelyan's arguments with reference to localization, must immediately fall back upon the ground that localization is impossible, owing to the duties that our armies have to perform in the colonies. If you can remove that part of the question, put the colonial service aside, the question will be very much simplified. I will not go into the arguments about the colonies, but I will say this, that there is plenty of ground and plenty of authority on the side of those who advocate that the foreign service of our active embodied Army in time of peace should be limited to India and the road to India. Having once established that principle, a great number of the difficulties of organization vanish. Well, supposing the foreign service of our Army in time of peace to be limited to India, the next question is, in time of war, what would you require your Army to do? Because upon that depends the strength of your Army. You must estimate its strength by what that army will be required to do in time of war. It would be impossible to go into the whole question of what effect an American war would produce, or a Russian war would produce, or a French war would produce. It is sufficient to say that we should require a very large Army; and that we should require an army of reserve to reinforce and become part of the active Army, available for service not only in England, but wherever they might be wanted. I will now come to the question with regard to localization. That distribution would admit of localization; therefore the difficulties, resting upon the ground of distribution in opposition to the possibility of localization, cease. And if localization is possible on the ground of distribution, I think it will appear, upon consideration, that it is a principle which is necessary to be incorporated with our army system, if short service, as it must be, is introduced. It would be impossible to give all the reasons for this. At all events, we are all agreed upon one thing, that it is necessary to offer all the inducements we can to men to enlist, whether for short or for long service. Now, take the case of a non-localized service, take the case of a non-localized corps with long colonial service; what are the inducements you offer to men to come into it? They appear to me to be these, and they are easily gathered from Sir Charles Trevelyan's pamphlet, which I have summarized. You offer a man, as an inducement with this long colonial service, expatriation to begin with. Then, he is to remain a single man, or he is to exist in a state of married

misery. The next thing you offer him is severance from his family, and from his local and civil connections. And the last thing you offer him is idleness, which is the root of all mischief. Take the case of a localized service; there is no hindrance to a man getting married. If your periods in the Army are short, your periods on foreign service must be short. Therefore, it is no hardship to a man to be separated from his wife for a short time; the expense of removing the wife does not enter into the question, therefore a man may marry when he chooses without the military authorities exercising any control. Short service, of course, does away with expatriation. Thirdly, with short service you offer a man a fixed home. Fourthly, you afford him the opportunity of adding to his soldier's pay by working at a trade, both for his own benefit and for the benefit of the State. Everybody knows what a non-localized service is, what its inducements are, and what the life is. A localized service is not so well understood, because there are few instances of the kind. I will therefore briefly wind up by describing a service of about 3,000 men, half of whom are perpetually abroad. Their period of service abroad averages three years and a half, Officers and men. Therefore, you have about 1,500 continually at home. You may call it one battalion abroad, and one battalion at home, if you like. The men at home by being fixed, and having families, and keeping up their local connection, are enabled to make all the articles of clothing, except boots, and could make all the boots and appointments of the whole regiment at a considerably reduced cost. That is an advantage to the Government, and it is a considerable advantage to the men. And not only that, but by localization you have the power of employing your men at trades, and of utilizing their labour under the control of the Government for the purposes of the State. I do feel this—the more the question is ventilated, the more the whole subject is gone into—that localization and short service are in reality the two fundamental principles in Army Reform, which must be carried out.

The CHAIRMAN: Now, Colonel Robertson, perhaps you would like to reply.

Captain BURGESS: I should like to ask one question. Colonel Robertson says, "that during peace the appointment of subalterns to regiments of Militia be "discontinued, and during the annual training their duties be performed by sub-"alterns detached from regiments of the Line." I should like to know whence he is to get subalterns for the Militia regiments, when war breaks out?

Colonel ROBERTSON: I am not prepared at present to offer any suggestion as to the best means of providing subalterns for Militia regiments when embodied for actual service. My observations merely referred to the existing state of things. I look at the Army list, and where lists of subalterns of Militia ought to be, I find nothing but asterisks. I ask the reason, and am told that properly qualified persons cannot be found to accept these commissions. But I feel persuaded that the prospect of a war would cause this difficulty to vanish—there would be an abundance of applicants, and four months' training would suffice to convert those selected into excellent Officers. In time of peace not only is it practically impossible to find properly qualified persons who will accept subaltern's commissions, but if this difficulty were overcome, we should have a still greater difficulty to contend with. In time of peace we have not the means of instructing militia subalterns in their professional duties. I therefore do not see any means of obtaining the services of well-trained subalterns in time of peace, when Militia regiments are assembled for the purposes of instruction, excepting by borrowing them from line regiments. I think it will be admitted that this expedient is better than the present state of things; but of course if means can be found to induce gentlemen to serve in Militia regiments as subalterns on the same terms as the Captains serve, and to attach themselves to regiments of the Line, until properly instructed, this will be better still. As regards Colonel Ouvry's remarks concerning the derelictions of duty with which he charges those Officers who invest money in the purchase of promotion, I do not know that I can make a better answer than to appeal to his own personal experience.

Colonel OUVRY: Do you dispute the facts?

Colonel ROBERTSON: I do not dispute the facts, but the answer I wish to make is, that I do not think they establish the inference you draw from them. I shall mention the names of two Officers, both personally known to Colonel Ouvry, as

well as to myself. One of them, Colonel ———, served in my own regiment, the 8th, through the whole of the Indian mutiny; the other, Colonel ———, served in Colonel Ouvry's regiment, the 9th Lancers, and was killed at the siege of Delhi. Both of these Officers, as Colonel Ouvry well knows, had expended large sums of money in the purchase of their commissions. I ask him if he ever knew, if he believes that in the whole Army it would be possible to find Officers who were more zealous and assiduous in the performance of their duties, more devotedly attached to the service than the two I have named? Both had strong inducements to leave the Army, one of them had sufficient private fortune to enable him, had he wished to do so, to live a life of ease and pleasure at home. The other had invested nearly the whole of his means in the purchase of promotion, and he had a wife and children for whom, if the money so invested were lost, he could make no adequate provision. But did either of these Officers desert his post?

Colonel OUVRY: Hundreds did so.

Colonel ROBERTSON: Hundreds may have done so, but if, after a brief experience of the fatigues and dangers of a campaign, there are always a good many rich Officers who desert their posts by selling out, are there not always a good many poor Officers who would be glad to follow their example if they had the means of doing so; and of these unwilling soldiers, are there not always a few who under various pretences manage to evade their duty quite as disreputably to themselves and much more injuriously to the Service, than if they had sold their commissions? In time of war an Officer is worth nothing unless his heart is in his work, and it is extremely probable that the proportion of poor Officers who serve unwillingly, and only because necessity compels them to do so, is quite as great as the proportion of rich Officers who sell out because they prefer safety and ease to hardships and duty. Do not therefore let us suppose that the quality of our Officers would be improved if we could devise some arrangement which should render every Officer dependent on his pay, and prevent any Officer from leaving the Service, however inconsistent he might find it with his domestic duties and private interests to remain in it. As to the general question, how are we to get good Officers? Do not suppose that any method of selection, any rate of pay, or any system of training will make, I do not say all, or the majority, but more than a small minority, really good Officers. Sir Charles Trevelyan's plans all hinge on the idea that it is possible, by means of selection and training, to get a body of Officers, each of whom shall be thoroughly efficient, and to all of whom it is desirable to offer such advantages as will make it the interest of every individual Officer to devote his life to the performance of military duties. A certain proportion he would promote from the ranks, and the remainder he would take from the public schools, and have them specially trained at military colleges, so as to make them professional soldiers. Now I think that this method of constituting a corps of Officers is erroneous in principle. In order to get a really efficient body of Officers, you must regulate the duration of their term of service in the same manner that Sir Charles Trevelyan recommends you to regulate the term of service of private soldiers. Inducements to prolonged service must be offered only to the select few; the duration of the service of the remainder must be limited to as short a term as circumstances will admit of. Supposing it to be practicable, the best possible arrangement for the interests of the State would be to limit the first commission of an Officer, like the first engagement of a recruit, to a short term of years, at the expiration of that term, to pick out a sufficient number of the best, to provide for vacancies in the command of regiments, to grant those picked men new commissions, and to discharge the remainder. But if considerations of economy, or the adverse interests of individuals, rendered it impossible to secure for the State the option of discharging Officers after a short term of service, care ought at least to be taken so to regulate our Military Institutions as to provide motives which favour voluntary retirement, and to eliminate motives which favour prolonged service. Although I am strongly opposed to the purchase system, yet I think that by facilitating early retirements, it is more beneficial to the interests of the State than such a system would be as that proposed by Sir Charles Trevelyan, which makes it the interest of every Officer to devote his life to the Service. If Officers, instead of being promoted by seniority or by purchase, were selected for the command of regiments on account of their possessing

special qualifications for command, this mode of promotion, besides securing picked men for performing the important duties of the superior regimental ranks, would also have the effect of driving off the chaff. It would be even more efficacious in promoting early retirements than the purchase system.

Colonel OUVRY: You do away with purchase, then?

Colonel ROBERTSON: Undoubtedly I should like to see purchase done away with, but only on this condition, that the system of promotion substituted in its place provided some effectual means for selecting picked men for the command of regiments. This I consider the essential and indispensable condition of any real improvement in our regimental organization. I would rather a thousand times have purchase than seniority. The Artillery, in which promotion goes entirely by seniority, I consider a dead and lifeless service. It is slower, and has less vitality than the Line. I am an uncompromising opponent of purchase, but there is no scheme proposed as a substitute which I consider so much better as to be worth the inconveniences of a change of system.

Sir CHARLES TREVELYAN: I would train our Officers and I would pay our Officers as if they were to follow the profession to the end of their days; but I have that reliance on the military spirit of our people, and upon the habit that our young aristocracy have formed of pursuing the military profession during their early leisure years, that I am confident that practice will go on even more than ever; and in proportion as we raise the standard of our Officers' qualifications, we shall get a better supply from that class.

Colonel ROBERTSON: As far as I know, I do not know any one that is in favour of purchase. Colonel Baker is dead against it.

Sir CHARLES TREVELYAN: You were speaking of selection, and I did not see how you squared it, hence my remark.

Colonel ROBERTSON: No one defends purchase, but many who disapprove of it confess that they have nothing better to propose. The only scheme that came before the Royal Commission of 1857, which had any pretension to deal adequately with the difficulties of the subject, was that proposed by Sir Charles Trevelyan. If that scheme had been adopted, it is true we should have got rid of purchase, but what should we have got in its stead? We should have got seniority, which I think more pernicious than purchase, and we should also have got promotion from the ranks, which I think still more pernicious than seniority. After carefully reading Sir Charles's scheme, I said to myself in despair, if the only choice is between this scheme and the old system, for God's sake let the old system remain. Subsequent consideration of the subject has, however, strongly impressed me with the idea that it is quite possible to relieve the Army from the evils of the purchase system, without inflicting upon it the worse evils of a seniority system, combined with a system of promotion from the ranks, and also without adding a single sixpence to the Army Estimates. How this may be done, I have endeavoured to explain, in a paper on "The Appointment and Promotion of Regimental Officers," published in the twelfth volume of the Journal of this Institution. The great difficulty is to find some means of abolishing purchase without causing a stagnation of promotion. Without purchase, how are you to secure tolerably rapid promotion?

Colonel OUVRY: By compulsory retirement.*

Colonel ROBERTSON: Compulsory retirement would be expensive; and to

* [These further remarks are added at Colonel Ouvry's request.—ED.]—I am further of opinion that promotion from the ranks is the only proper mode of officering the Army, but not from the class which now prevails in them—indeed any Commanding Officer would tell you that he has very great difficulty in finding Non-commissioned Officers. Of course to think of promoting men from the ranks as now constituted, would be simply absurd. But if it were known that the ranks were a certain stepping-stone to a higher position, the sons of clergymen, county gentlemen, and others would enlist, and thus the character of the whole Army would be raised; a few educated men in the ranks would leaven the whole mass, and we should have, if not so rich, certainly a more efficient body, who, depending on the Army as a profession, would have no inducement to fall away in the time of difficulty and privation.

make it worth the money it would cost, you must combine it with a system of selection. It is not sufficient that the Commanding Officer of a regiment should be young. He should also be a picked man. He should be zealous, energetic, intelligent, and thoroughly trained. Compulsory retirement will create vacancies, but it will not help you to fill them up. It is only by means of a system of selection, such as that which I had last year the honour of submitting to the members of this Royal Institution, that the State can make sure that any money which may be spent to create vacancies will secure the promotion of Officers worth the outlay—of Officers to whom, on account of their natural capacity and the special training they have received, it is for the public interest that the command of regiments should be given at an early age. It is admitted to be essential to the efficiency of a regiment that the adjutant and the sergeant-major should be picked men. It is surely still more essential that he who selects and controls the adjutant and sergeant-major, should be himself a man of more than average ability; that he should be one of those men endowed with a special aptitude for command, who even when placed in a subordinate position, practically control and direct their superiors. Superficially considered, promotion from the ranks might be believed to be a system based on the principle of selection, but in reality it is diametrically opposed to it. Officers promoted from the ranks are no doubt the best men of their class. They are excellent soldiers; but to suppose that an excellent soldier possesses the qualifications requisite to make a good Officer, is an error of the same kind as to suppose that an excellent attorney's clerk possesses the qualifications requisite to make a good judge.

The CHAIRMAN: I am sure that you will allow me to return your thanks to Colonel Robertson for his very valuable address.

APPENDIX.—Vide p. 478.

Classified Summary of Suggestions made by various Writers and Speakers for the Improvement of our Military Institutions.

A. ENLISTMENT.

I. Suggestions relative to mode of enlistment.
II. Suggestions relative to duration of the Military engagement.
III. Suggestions relative to inducements to voluntary enlistment and to increasing attractions of military service.

B. ORGANIZATION.

I. Suggestions relative to command and superintendence.
II. Suggestions relative to the constitution and mutual relations of the tactical and administrative divisions of the forces.
III. Suggestions relative to the appointment and promotion of Officers.
IV. Suggestions relative to territorial distribution of troops.

C. TRAINING.

Suggestions relative to military training, individual and collective.

A I. ENLISTMENT. *Suggestions relative to the Mode of Enlistment.*

GENERAL CONSENT. All writers and speakers consider that, in time of peace, voluntary enlistment is the only practicable mode of recruiting the regular Army.

The advantages of voluntary enlistment are well and briefly stated by Colonel Baker at p. 26 of his pamphlet on Army Reform.

Lord ELCHO suggests that 5,000 young men in their twentieth year should be selected by ballot for five years' Militia service.—(Report of Debate, *Times*, 11th June, 1869.)

Colonel BAKER suggests that 500,000 men should be drawn by ballot from a list including the whole male population between eighteen and thirty, and that each of these 500,000 men, unless he provide a substitute within twelve months, should be liable to a second ballot, to supply vacancies in Militia regiments,—(Army Reform, p. 41.)

Sir J. BURGOYNE points out that the formation of a strong Reserve of trained soldiers is incompatible with a system of voluntary enlistment.—(Our Defensive Forces, p. 17.)

Lieutenant-Colonel BANNATYNE thinks that the Army, as at present constituted, is composed of that class of the population best adapted for military service. The Militia, he thinks, should be exclusively composed of agricultural labourers and town artisans, and married should be preferred to single men.—(Our Military Forces and Reserves, by Lieutenant-Colonel J. Millar Bannatyne, 1867, pp. 5—19.)

Mr. CARDWELL disapproves of ballot.—(Debate in *Times*, 11th June, 1869.)

A II. ENLISTMENT. *Suggestions relative to Duration of Military Engagement.*

Mr. CARDWELL thinks it desirable that the military engagement should be long; that it should be divided into two periods; the first in the line should be as short as possible, the remainder in the reserve.—(Debate reported in *Times*, 11th June, 1869.)

H. COLE, Esq, C.B. Soldiers required for permanent military duty in India to be enlisted for seven years. Men required for permanent military duty at home to be enlisted for twelve months, and then returned to civil occupations.—(Report of Meeting of Society for the Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

Sir A. ALISON, Bart. Twelve years, with right to re-engage for term necessary to complete total of twenty-one years. Soldiers of not less than seven, or more than ten years' service to be permitted to volunteer for five years' service in reserve.—(Army Organization, pp. 34 and 40.)

Lieutenant-Colonel BANNATYNE. Twelve years, with right to re-engage for term necessary to complete total of twenty-one years' service, but that practically the total compulsory service with the colours

should be reduced to about fifteen years, by means of a scheme for a Reserve force, which he indicates.—(Our Military Forces, &c., pp. 71, 73.)

Sir J. BURGOYNE. Six years for home service; twelve years for East Indies and the Colonies.—(Our Defensive Forces, p. 16.)

Colonel BAKER. Maximum fourteen years, minimum four years. None excepting non-commissioned Officers to be permitted to re-engage.

The Militia engagement to impose liability to be drafted into line regiments in time of war.—(Army Reform, pp. 29 and 38.)

Lord ELCHO (approved by Sir HOPE GRANT). Twenty-one years, divided into three periods of seven years each:—

1st Period. Continuous military duties either at home or abroad.

2nd Period. During peace, periodical training; during war, liability to continuous service, either at home or abroad.

3rd Period. During peace, training to be limited to a few days in the year; during war, exemption from liability to foreign service.—(Letter in *Times* 16th February, 1869.)

Lord MONCK. Twenty-one years, at the end of second year, each recruit to have the option of completing the remainder of his term of service, either in the Line or in the Militia. During war, all Militiamen to be liable to general service.—(Report of Debate, *Times*, 24th April.)

Lord NORTHBROOK. Twelve years; five continuous, and seven in reserve, or *vice versâ*.—(Report of Debate, *Times*, 24th April, 1869.)

Lord GREY. Engagement to include a short term of service in the Regular Army, followed by a second term in Reserve.—(Appendix to Report of Recruiting Commissioners, 23rd August, 1866.)

Sir CHARLES TREVELYAN. After one year's continuous training at a depôt, recruits to have the option of seven years' service in the Line, or of ten years' service in the Militia, terminable at six months' notice.—(British Army in 1868, p. 62.)

Lieutenant-Colonel LEAHY, R.E. Three years, this followed by twenty-seven years' service in Reserve, to give a right to a permanent pension.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

The Duke of CAMBRIDGE recommends that the systems of long and of short engagements be tried concurrently, the recruit being allowed the option of enlisting for a long or for a short term of years.—(Report of Debate, *Times*, 24th April, 1869.)

Lord NORREYS. Certain Militia regiments to be induced to volunteer for liability to foreign service, these regiments to receive extra pay and to be bound for a longer period.

A III. ENLISTMENT. *Suggestions Relative to Inducements to Voluntary Enlistment, and to Increasing Attractions of Military Service.*

Sir CHARLES TREVELYAN. Reduction of terms of engagement from twelve to seven years.

2. Abolition of the purchase system. Improvement of terms of

service of Officers, and promotion from the ranks of a certain proportion of the regimental establishment of Commissioned Officers.

3. Permission to Non-commissioned Officers, and a certain proportion of picked men, to re-engage and serve until superannuated on a permanent pension.

4. Rendering military service an indispensable condition for obtaining appointments in certain branches of the administrative departments of the Army, and of the Civil Service.—(Standing, or a popular Army, p. 14.)

Lord Elcho. Soldiers who engage for a second period of seven years' Reserve service to receive pay at the rate of 3d. or 4d. a-day; those who engage for a third period of seven years' reserve service to receive 6d. or 8d. a-day, and at conclusion of period, a pension of same amount for life.—(Report of Debate, *Times*, 11th June, 1869.)

Lieutenant-Colonel Bannatyne. Soldiers who re-engage in Reserve, to receive £6 per annum, permission to marry, and rations, and an allowance of 3d. per diem for wife, and 1½d. for each child when on permanent duty.

Pension to be granted after twenty-one years' service. Serving in Reserve to reckon not less than half Line-service, and a deduction to be made for each year's service abroad.

Soldiers in Line regiments to receive classified rates of pay, regulated according to proficiency.

Rates of pay to be increased when any rise takes place in the value of labour.

Sir A. Alison. Soldiers of seven years' service, who engage for five years' service in Reserve, to receive pay at the rate of 6d. a-day.

Soldiers of fifteen years' service, who engage in Reserve, to receive pay at 6d. a-day, and after six years' service a permanent pension of same amount.—(Army Organization, pp. 34 and 41.)

Lieutenant-Colonel Leahy. Soldiers who re-engage for Reserve-service to receive £8 per annum, and on completion of thirty years' service (of which three years are to be in a Line regiment) a permanent pension.—(Journal of Royal United Service Institution, vol. xii. No. 50.)

Lord Monck. Abolition of purchase and substitution of Sir C. Trevelyan's scheme.

Reserve soldiers to be remunerated by small annual retaining fee (amount not specified).—(Report of Debate, *Times*, 24th April, 1869.)

Lord Northbrook. Soldiers to be taught trades. Vacancies in certain departments of the Civil Service to be filled by men who have completed a term of military service.—(Report of Debate, *Times*, 24th April, 1869.)

Lieutenant-Colonel Baker estimates that a bounty of £5 would be sufficient to induce men to enlist in the Militia for a period of five years, subject to the condition of liability to be drafted into the Line in time of war.—(Army Reform, p. 59.)

The Duke of Cambridge thinks that the promise of pension is the chief inducement which attracts recruits.—(Report of Debate, *Times*, 24th April.)

Mr. CARDWELL. 1. Pensions to be granted to Non-commissioned Officers and a certain proportion of picked men.

2. Civil patronage to be made subservient to procuring recruits.—(Report of Debate, *Times*, 11th June, 1869.)

H. COLE, Esq., C.B. When lads leave school, every inducement to be given them to elect between joining the Militia or becoming Volunteers. A certificate of having served well in the Line, Militia, or Volunteers to be a necessary qualification for obtaining civil employment.

Payment and pensions of troops required for permanent service, to be liberal in time of war; in peace to be regulated by rate of wages and necessities of case.—(Report of Meeting of Society for Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

B I. ORGANIZATION. *Suggestions relative to Command and Superintendence.*

Lord NORTHBROOK declared that it was the policy of the Government to establish a uniform system of command, administration, and supply for all branches of our military forces.—(Report of Debate, *Times*, 4th April, 1869).

Mr. CARDWELL stated that the regular Army, Militia, Yeomanry, Volunteers, and every other description of military force, would be placed under the control and superintendence of the same Staff.—(Report of Debate, *Times*, 11th June, 1869).

Sir A. ALISON suggests that every description of military force should be placed under the direct command of the Commander-in-Chief, acting through Generals and Staff Officers appointed by him.—(Army Organization, p. 57.)

Lieutenant-Colonel BANNATYNE considers unity of command and administrative simplicity to be a necessity, and suggests that the Militia should be placed under the effective superintendence of General Officers commanding districts.—(Our Military Forces and Reserves, p. 59.)

Lord ELCHO suggests that special Inspectors should be abolished, and that the Militia and Volunteers be placed under the supervision of the General Officer in command of districts.—(Debate reported, *Times*, 11th June, 1869).

Lord MONCK suggests that all descriptions of military forces should be placed under the same executive control, and the supply services of all descriptions of troops should be managed by the same administrative Staff.—(Debate reported *Times*, 24th April, 1869).

B II. ORGANIZATION. *Suggestions relative to the Constitution and Mutual Relations of the Tactical and Administrative Divisions of the Forces.*

Sir C. TREVELYAN. Regulars, Militia, and Volunteers to be tactically incorporated and organized as battalions of composite county regiments.—(A Standing or a Popular Army, p. 14.)

Sir A. ALISON. Regulars re-engaging in reserve to be incorporated with regiments of the line and local corps of Pensioners.

A local Indian Army of 40,000 men to be formed.

Battalions on peace establishment to be complete in Officers and in non-commissioned Officers. Strength of privates to be reduced one-half.

Militia and Volunteers never to serve in same brigade.—(Army Organization, chap. ii.)

Colonel BAKER. Peace establishment of a battalion to consist of 500 privates, with full complement of Officers and non-commissioned Officers.

Militia to be incorporated with Line battalions for training during an annual autumn concentration in camps for field manœuvres.—(Army Reform, chap. v.)

Lieutenant-Colonel BANNATYNE. Soldiers re-engaging for Reserve to be organized as a distinct force, separate from Militia, having a contingent of reserve attached to it, &c.

Mr. CARDWELL. The Army to be small; the Reserve large. Troops of the Line, Militia, and Volunteers to be welded together and consolidated.

The Reserve of the Line to be distinct from the Militia. To be trained with the Line in peace, and incorporated with it in war.

A large number of weak battalions preferable to a smaller number of strong.

Complete *cadres* better than strong establishments.

Disapproves of a separate establishment for India.—(Debate reported in *Times*, 11th June, 1869.)

H. COLE, Esq., C.B. India to have a distinct Army. Home establishment to consist of one *corps d'armée* of 16,000 men, organized on Prussian principle, supported by a reserve of Staff Officers, Engineers, Artillerymen, Marines, Hospital Staff, &c., the strength of which is estimated at 30,000 men.—(Report of Meeting of Society for Encouragement of Arts, &c., 17th February.)

Lord ELCHO. Volunteer brigades to be kept separate, and to be commanded by Volunteer Brigadiers.—(Letter to *Times*, 12th February, 1869.)

Lord MONCK. Regiments for home service to consist of one service battalion of 500 men, with complete *cadre* of Officers and non-commissioned Officers, and a second or depôt battalion of 400 men. A sufficient reserve of trained soldiers to be borne on the books of each service battalion to raise its strength to 1,000 men.

Militia in case of war to be liable to be embodied for general service.—(Debate reported *Times*, 24th April, 1869.)

Lieutenant-Colonel LEAHY. Soldiers who re-engage to be incorporated and drilled with regiments of the Line.

A regiment of the line to consist of one service battalion and one home battalion, having a contingent of reserve attached to it and borne on its muster rolls.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

Volunteers to be brigaded separately.

B III. ORGANIZATION. *Suggestions relative to the Appointment and Promotion of Officers.*

Sir C. TREVELYAN suggests that purchase should be abolished; that a certain proportion of all vacant commissions should be filled by promotion from the ranks; the remainder, by selection from the pupils of military schools.—(The British Army in 1868, p. 9.)

Sir A. ALISON. Purchase to be abolished above the rank of Captain. No Officer who had not purchased, to be allowed to sell. Command of a battalion to be limited to six years, after which Colonel to have the option of retiring on full-pay or of receiving capitalised value of pay.

Militia volunteers and pensioners to be officered from half-pay list.

Disapproves of promotion from ranks.—(Army Organization, p. 68.)

Lieutenant-Colonel BAKER. Purchase above rank of Captain to be abolished. Field Officers to be selected by a military board.

Disapproves of promotion from the ranks.—(Army Reform, p. 52.)

Lieutenant-Colonel BANNATYNE thinks it practically impossible to substitute for the purchase system a system of promotion that will work better.

Suggests that Militia should be officered from retired and full-pay lists.

That specially qualified men should be enlisted for appointment as Non-commissioned Officers, after one year's service in the ranks, with right to claim discharge at any time if deprived of their non-commissioned rank.—(Our Military Forces and Reserves, pp. 29, 40, 28.)

Lord ELCHO. Volunteer Officers to be required to qualify for appointment and promotion, by a term of service with a line regiment.

Half-pay Officers unsuitable for command of Volunteers, local influence requisite as well as military knowledge.—(Letter to *Times*, 12th February, 1869.)

Lord MONCK. Purchase system to be abolished.—(Debate reported in *Times*, 24th April, 1869.)

Lieutenant-Colonel LEAHY. Purchase system to be abolished. Battalions to be commanded by Officers specially selected from a general list of Field Officers.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

Colonel ROBERTSON. Purchase of promotion to be abolished. A certain proportion of first commissions to be disposed of for a regulated price, not subject to condition of repayment on purchaser leaving the Service.

The remainder to be filled by competitive examination among candidates possessing certain qualifications defined by regulation.

Field Officers to be promoted by seniority from classified lists of Captains possessing one or more special qualifications defined by regulation. Changes of position to be permitted between Officers of the same rank, and Officers to be permitted to accept money as an inducement to retire or exchange.

The command of regiments of the line to be limited to a certain term of years.

The command of regiments of Militia to be given 1st, to Colonels of the Line who have completed their term of command of a Line battalion; 2nd, to Field Officers of the Line selected from the half-pay list.

Adjutants of the Militia and Volunteers to be selected from unmarried Captains of the Line, a preference being given to old Adjutants, and the duration of the appointment being limited to three or five years.—(Journal of the Royal United Service Institution, vol. xii, No. 49.)

Mr. CARDWELL. Patronage of Militia regiments to be local, and purchase of Militia adjutancies to be prevented.—(Debate reported in *Times*, 11th June, 1869.)

B IV. ORGANIZATION. *Suggestions relative to Territorial Distribution of Troops.*

Mr. CARDWELL. Country to be divided into military districts, and all troops serving in the district to be under one chief, assisted by one set of executive and administrative Staff Officers.—(Debate reported in *Times*, 11th June, 1869.)

SIR C. TREVELYAN. A separate complete military establishment, consisting of troops of the Line, Militia, and Volunteers, united by a regimental organization to be allotted to each county or military district.—(A Standing or a Popular Army, p. 14.)

Lord ELCHO. Line regiments to be attached to particular localities.

Lieutenant-Colonel LEAHY. Permanent Head-quarters to be assigned to each regiment.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)*

Lord MONCK. Each Line regiment to have a second battalion, having permanent head-quarters in a particular locality.—(Debate reported in *Times*, 24th April, 1869.)

C. TRAINING. *Suggestions relative to Military Training, Individual and Collective.*

Mr. CARDWELL. Training of soldiers transferred to Reserve, to be of the same character as that of Volunteers. Militia recruits to be trained by Officers of the Line. Yeomanry to be trained as mounted rifles.—(Debate reported, *Times*, 11th June, 1869.)

Sir C. TREVELYAN. Soldiers' training to include school work as well as drill and gymnastic and military exercises.

Recruits for Line and Militia regiments to be trained together at the same depôt.

Officers of Militia and Volunteers to go through a prescribed course of instruction at head-quarters of Line regiments.—(A Standing or a Popular Army, p. 14.)

* See also papers by Captain Colomb, R.M.A., and Lieut.-Col. Malet, Gren. Gds., vol. xiii, pp. 37, 160.—ED.

Sir A. ALISON. Each year all forces in one military district selected by lot, to be called out by telegraph to be assembled at a given point and distributed in garrisons and strategic positions.—(Army Organization, chap. ii.)

Lieutenant-Colonel BAKER suggests appointment of regimental Officer-instructors; one or more divisions to be assembled annually in the autumn under canvas, and manœuvred over an extensive tract of country (at least 30 miles by 20).—(Army Reform, p. 36.)

Lieutenant-Colonel BANNATYNE suggests that in towns it might be convenient to conduct the greater part of Militia training by companies in the vicinity of their homes on Saturday afternoons, in the same manner as the Volunteers are trained.—(Our Military Forces and Reserves, p. 22.)

Lord ELCHO. All the military forces of each district to be assembled for annual training under the General of the division. Supply and administrative services of the whole force to be performed by permanent Staff.

He also suggests simplification of drill, and that trades should be taught in addition to military exercises.—(Letter in *Times*, 12th and 16th February, 1869.)

Lord NORTHBROOK. Officers of Line regiments to be attached to Militia during annual course of instruction to assist in training.—(Debate reported in *Times*, 24th April, 1869.)

H. COLE, Esq., C.B. Compulsory drill to form part of the national system of education, to commence at ten years of age. Military pensioners to be attached to all schools as drill instructors.—(Report of Meeting of Society for Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

LECTURE.

Friday, June 18th, 1869.

Colonel T. ST. L. ALCOCK, Vice-President, in the Chair.

PRIMITIVE WARFARE—Section III. ON THE RESEMBLANCE OF THE WEAPONS OF EARLY RACES, THEIR VARIATIONS, CONTINUITY, AND DEVELOPMENT OF FORM—METAL PERIOD.

By Colonel A. H. Lane Fox.

Having in two previous lectures upon "Primitive Warfare," delivered at this Institution, spoken of the general principles to be observed in studying the development of the weapons of savages and early races, I need not preface the remarks I am about to offer by any detailed allusion to the generalizations which I have already ventured to make, but I will proceed at once to lay before you some additional facts which I have collected in continuation of the same subject.

This I do the more readily, because I hold strongly to the opinion that the value of a communication of this kind may, in a great degree, be measured by the attention which is paid to the accumulation of facts, and to the comparative brevity and simplicity of that portion of it which relates to theory. Without general principles, however, we should have no incentive to collect and systematize our facts, and they are therefore valuable even where they involve,—and in a new field of study, such as I am now treating, with very scanty materials as yet at our disposal to assist conjecture, I can hardly hope they should not involve,—a certain amount of error.

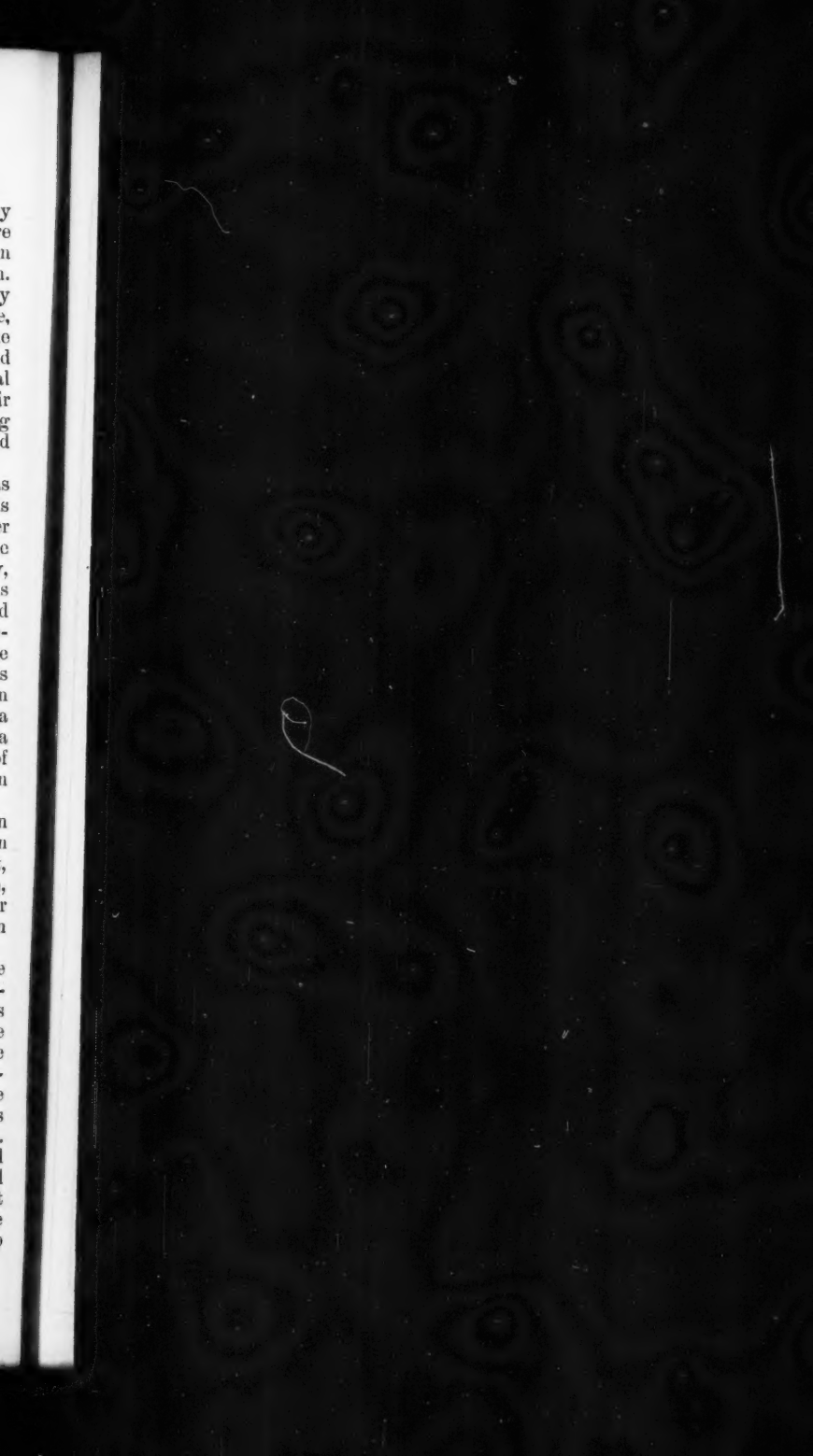
Before entering upon the subject of the origin of metal implements, I must, however, revert to one part of my former communication, in order to show that a statement I then made in reference to the geographical distribution of the boomerang has since had some light thrown upon it by the researches of one of our most eminent men of science. It will, perhaps, be remembered by those who did me the honour of reading my last lecture, which was printed in No. 51 of the Journal, that, in describing the weapons of the Australians, I showed, by means of numerous illustrations of the varieties of each class of

weapon from that country, that they all passed one into the other by connecting links, so that where a sufficient number of them are arranged in such a manner as to exhibit their continuity, it is often impossible to determine any definite line of separation between them. I also showed that the form of each weapon was determined by the form of the stem or branch of the tree out of which it was made, the outline of all these implements conforming to the grain of the wood; and the inference which I drew from this was, that it showed a very low state of intellect on the part of the constructors, the several classes of implements not having been designed originally for their respective purposes, but produced accidentally, and then applied during subsequent ages to the several uses to which in practice they appeared most suited.

As we have no reason to suppose that the Australian continent was peopled at a later date than other parts of the world, and as there is no evidence upon that continent of the people inhabiting it having ever been in a higher state of civilization than they are at present, we have grounds for supposing that they must have remained stationary, or have progressed very slowly, while the inhabitants of other parts of the globe advanced more rapidly, and that their existing arts and implements, simple and primitive though they be, nevertheless represent the highest development of constructive power to which these people have ever attained. Hence it follows, that if the inhabitants of any other portions of the globe can be traced to a common origin with the Australians, viewing the persistency of type observable as a characteristic of the arts of these people, and of all other people in a primitive state of culture, we must expect to find some traces of similar implements in use amongst all such people, to whom a common origin can be assigned.

In my last lecture I mentioned that there were three countries in which the boomerang is either still used, or is known to have been used in ancient times, viz., Australia, the Deccan of India, and Egypt, and I also showed some grounds for believing that the same weapon, or something allied to it, may have spread from those countries over Europe, as it is known to have done over a great part of Northern and Central Africa.

Although the comparison of weapons from various parts of the globe can have no other object than to trace out an original connection, I did not venture to build upon the coincidence of this weapon in these regions, any argument for the common origin of the people by whom it was used. Nor do I think that I should have been justified in assuming such origin upon the grounds of the identity of a single weapon. Such identity may have arisen in three ways:—1stly. It may have arisen independently by the spontaneous development of like weapons under similar conditions of life; 2ndly. The weapon itself may have been communicated from some primal source; 3rdly. The races using it may have been themselves derived from a common origin. Of these, the first view, viz., the independent origin of the weapon, would perhaps strike any one at first sight, before having studied the conservatism and persistency of type which is so



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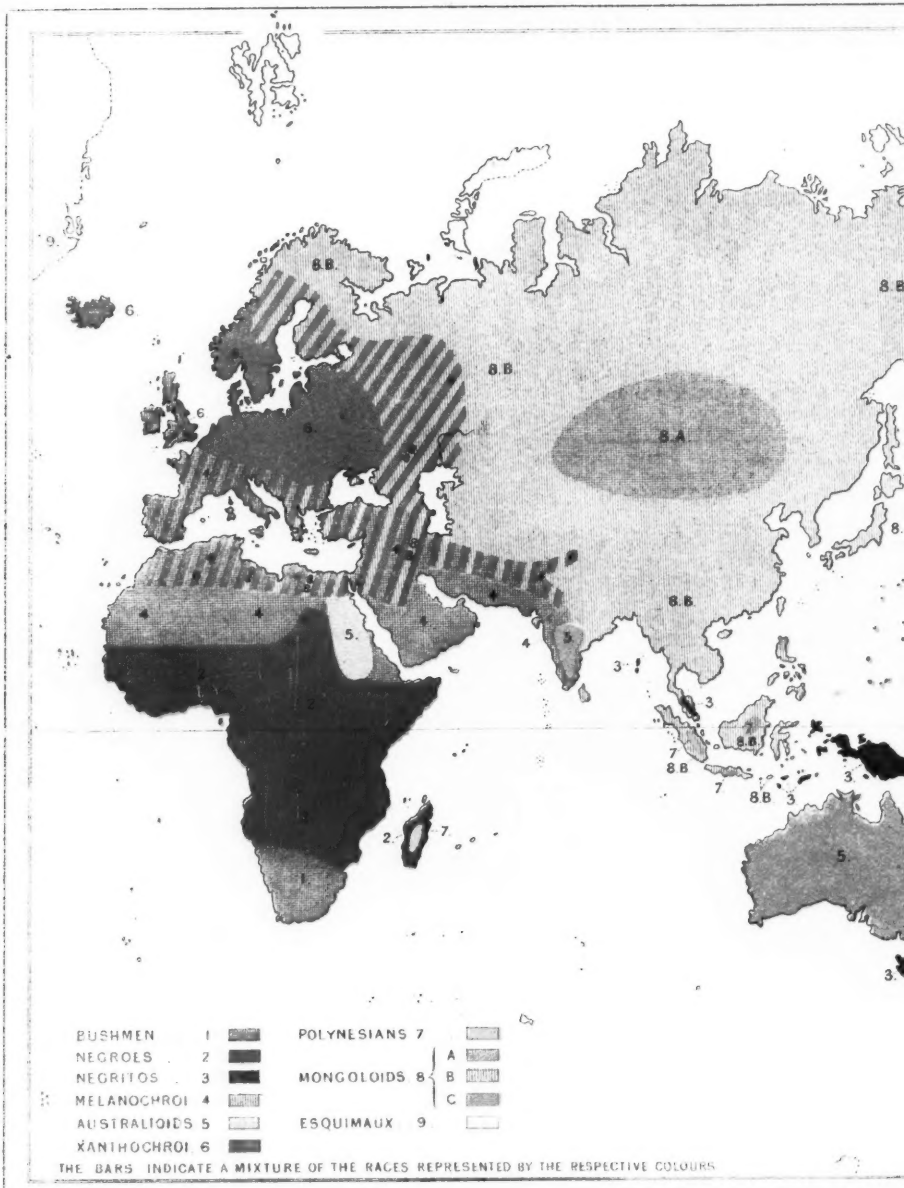
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AL MODIFICATIONS OF MANKIND ACCORDING TO PROFR HUXLEY.

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especially characteristic of savages, as the most probable; it appears so exceedingly simple in its form and uses to our trained and educated minds, that it seems hardly necessary to account for it in any other way; besides which, there are slight differences between the Indian and Australian boomerangs, which have been considered by some to distinguish the two weapons.

I will not here revert to the arguments which I have used to combat this opinion. Suffice to say, that I have since been favoured with much valuable information on the subject by Sir Walter Elliot, who has frequently accompanied the natives of India in their hunting expeditions with this weapon. He says that it is formed on the grain of the wood, like the Australian boomerang, the curve varying with the bend of the stem; it is whirled horizontally, with the end foremost, like the Australian practice, and is used by two tribes in the Deccan, viz., the Kolis of Guzerat, and the Marawárs of Madura, but more especially in its simplest form by the former, who are of the Dravidian, or black race of the Deccan. In a letter to me he says, speaking of these tribes:—"I have seen both, and, indeed, "served ten years in the latter district (Southern Mahratta), where "the crooked stick is used by all the lower orders every Sunday "during the hot season, when all agricultural labour is at a stand. "The villagers turn out in large numbers, and scour the jungle armed "with these sticks. Everything that rises is knocked over, deer, "hares, birds, even the wild hog and the tiger are occasionally (though "rarely, of course) included in the bag. I have seen a line of upwards "of 100 men and boys, and the boomerang whirling about in such "numbers, and with such precision, that even birds on the wing are "brought down. I never met with any regularly formed specimens, "except in the South; those in the North were mere angular sticks, of "very various form, as natural branches occurred; the favourite form "was a rather obtuse angle—nearly a right angle." Thus, whether we regard the purposes for which it is used, the material of which it is constructed, the manner of throwing, or the varieties of its form, the Indian and Australian boomerang is virtually the same weapon; and I think those who dispute their identity, appear rather to have had in view the "colkery stick" of Madras and of the Marawárs than the boomerang of the Kolis.

We may, therefore, I think, fairly consider the causes which may have led to the adoption of this weapon as sprung from a common source.

Since my last communication to this Institution, Professor Huxley has given to the world, in a paper read at the meeting of the International Congress of Prehistoric Archæology,—of which I had the honour to be General Secretary,—in August, 1868, his views "on the distribution of the races of mankind, as bearing on their antiquity." The paper created a considerable sensation in the scientific world, owing to the boldness of the generalizations contained in it, and, it may be added, a certain amount of opposition. The accompanying map (Plate XXXI) is taken from one drawn by Professor Huxley himself for the Ethnological Society, to illustrate this subject.

Basing his distribution of the human race on the principle that the characters of the hair and complexion are more permanent, and of greater value as a means of classification, than the bony structure of man, Professsr Huxley traces back the numerous varieties of tribes and races into what, for the present, may be regarded as four primary groups.

Commencing, for the convenience of my present subject, with the highest, or those which have shown themselves most capable of development, which, in all probability, is the wrong end of the scale to begin with, if we regarded them in their natural succession, the first of these groups is what he terms the Xanthochroid type (the distribution of which is marked red in the map), a people characterized by yellow hair and fair complexions, with blue eyes, who form a strong element in the composition of the population of this country and a great part of Europe, extending from thence through Scandinavia and Central Europe eastward into Northern India. Next to these he classes the great Mongoloid race (marked by various shades of yellow on the map), with yellow-brown complexions and black hair and eyes, of which the Kalmucs and Tartars represent the purest types, occupying the whole of Northern Europe and Asia, from Lapland to Behring Strait, and down to the southernmost parts of China, including also the Esquimaux, the Polynesians, and the whole of the inhabitants of the two continents of America. Thirdly, the negro race (marked black and brown in the map), long headed, with woolly hair, which has its head-quarters in all that part of Africa south of the Sahara, but has outlying branches widely detached, and occupying a broken line of islands extending in a belt from the Andaman Isles in the Bay of Bengal to the peninsula of Malacca, New Guinea, New Caledonia, and the adjoining isles, and having its southmost limits in the distant island of Tasmania. Lastly, we come to the Australioid race (marked dark blue), distinguished by dark chocolate complexions and black eyes, with long heads and soft wavy hair; these the Professor, upon physiological grounds, and after intimate acquaintance with these people in the distant regions in which they are found, traces in three distinct portions of the globe, viz., Australia, the Deccan of India, and Egypt; the three identical countries, it will be observed, in which, unconscious of Professor Huxley's distribution of races, I had traced the occurrence of the boomerang. I think, therefore, it is not an unreasonable conjecture, assuming the correctness of Professor Huxley's premises, that this peculiar weapon may be a relic of the original Australioid stock, which having been originally an effective weapon for all purposes amongst the aborigines of this race, and continuing still to be used as such in Australia, survived in India and in ancient Egypt merely as an implement for the chase and for amusement, much in the same way that in Europe, bows and arrows have survived amongst children to the present day.

In the remarks which I made upon the varieties of the African boomerang, I drew attention to the peculiarly curved form of the Nubian and Abyssinian sword, and I ventured an opinion that its

form may have been originally derived from that of the boomerang, of which weapon a variety, constructed of wood, is still in use by the inhabitants of the country; and I see no reason to doubt that the Abyssinian sword may have been the prototype of those numerous allied forms of iron weapons, the "Hunga Munga," &c., which throughout Africa are still used as missiles, and thrown with a rotatory motion like the boomerang. My conjecture on this subject appears to receive some confirmation from the very peculiar construction of one of these swords, which has lately been added to the museum of this Institution, and which is represented in fig. 1, Plate XXXIII. The angular form of the blade, swelling in the middle, presents such a close affinity to the Australian boomerang, as to strike even those who have not been led by the considerations I have mentioned, to look for a coincidence in these weapons. I noticed at the same time the very great resemblance between the rudimentary shields of the Australians and those of some of the inhabitants of the valley of the Upper Nile, which may also perhaps be accounted for in the same way. With a view of further connecting this primitive form of shield with similar defensive weapons in India, it is worthy of notice, that the hand-shield, having antelopes' horns projecting from it, a representation of which was given in my first lecture, Plate LII, figs. 66, 67*a*, and 69 (many of which are furnished with a small iron shield, or guard for the hand, though some are without this accessory), Sir Walter Elliot now informs me is used precisely in the same way as the Australian and African parrying-shields, viz., by catching the arrows and darts of the assailant, and parrying them off with the horns, thus favouring the conjecture that I ventured to put forward, that the square, oblong, and circular targets are defensive weapons of comparatively recent origin, being represented in a primitive stage of culture by a simple parrying-stick, derived originally from the club. The club is, as a general rule, the only defensive guard employed by races in the lowest stages of culture. These seem to have been replaced by parrying-sticks, held in the centre, and subsequently hollowed to receive the hand, or furnished with hand-guards, forming rudimentary shields; of which stage in the development of the weapon we are now able to establish connected traces in the three countries under consideration.

If the comparisons which I have made, and the conclusions I have ventured to draw from them, are found to stand the test of further investigation, as it appears to me reasonable to hope they will, the importance of studying the forms and uses of these primitive weapons in connection with other sociological and biological phenomena, as a means of tracing back the early history of mankind, will be well established. Of this, however, we may feel certain, that if a connection formerly existed between the inhabitants of India, Australia, and Egypt, the evidence of such connection will not be limited either to the colour of the hair and skin, or to the resemblance of their weapons, but will be found in other customs and institutions which they brought with them from their fatherland. The important generalizations of Professor Huxley, whether or not they ultimately hold good, have had the good effect of drawing attention to a comparison of

the inhabitants of these countries; and though it would be foreign to my present purpose to anticipate the result of these investigations in other branches not immediately connected with my present subject, I may mention that Officers acquainted with India and Australia have since pointed out resemblances in the hymeneal and other customs of those countries, which have not before been noticed, but which, when put together and compared, making all due allowance for the variations which are inevitable in the continuous development of all human arts and institutions, will, I doubt not, tend to give confirmation to the theory of races which the author of it has so ably advanced.

Having strayed thus far into the geological and biological aspect of the question, it is necessary to go a step further in order to apply the subject more generally to the origin of weapons, and at the same time to point out some difficulties which stand in the way of accepting this theory of races—difficulties of which Professor Huxley himself appears by his paper to be fully sensible.

The detached portions of the Australioid race are separated from each other by seas of considerable depth, and the same thing applies to the Negroid race. The Australians, he points out, though possessing ample materials for the construction of canoes, have never learnt to make any that are capable of traversing the great seas which separate them from their apparent kindred in other lands, and it is unlikely they should have forgotten the art of navigation if they had once known it. It is inconceivable, therefore, that they should have migrated from Australia to the Deccan, and to Egypt, during the existing geographical arrangement of sea and land, more especially as no trace of such migration is found upon intervening isles. He points out, however, that great geographical changes have probably taken place, and that those changes, in so far as our knowledge of them goes, are of a nature to account for the phenomena observed.

The region of the negro race in Africa is separated from Northern Africa and from Europe by the desert of Sahara, of which there is geological evidence to show that it was sea at a recent geological period. The same applies to the Deccan of India, which is separated from the Himilaya by the great alluvial plains of the Indus and the Ganges, which, having probably formed a strait before the miocene epoch, may have divided the black men inhabiting the Deccan from the Xanthocroid and Mongoloid races to the north. At the same time large tracts now occupied by the sea may then have been land, uniting or connecting by a chain of easily accessible islands, the regions in which men of the same colour and physical peculiarities are now found. But it will be seen by the map that the lines of distribution of two of the races, the Negroid and the Australioid, cross each other, and this, according to the theory of migration by land, appears to involve a succession of submersions and upheavals during the human period, which it is difficult to account for.

The distribution of races, according to supposed original distinctions of colour and complexion, will be seized upon by polygenists as an argument in their favour; for it will be said, according to this theory, that

the distinctions of race in the earliest times must have been as great, or greater, than they are at present.

There are three ways in which it has been attempted to account for these early distinctions of colour and persistency of type—1stly. By supposing the several races of man to have been separately created upon distinct continents of land. 2ndly. By assuming that on each primeval continent, man was evolved from the anthropoid apes of that continent.* Or, 3rdly, by supposing that these divisions of race, remotely and immeasureably distant though they be, nevertheless, carry us only a short way back into the history of man, and that still earlier ages, if we could penetrate them, would show the races of man united.

Now, with respect to the first assumption, that of creation, though we are not, of course, in a position to deny the possibility of it, I confess it appears to me unwarranted by any of the phenomena of nature. We have no knowledge of the special creation of any organized being; and how can we scientifically assume as probable, that, for the probability of which there is no sort of evidence of a nature that inductive science would be warranted in building upon. Continuity and development are seen to be the order of the universe. Man is seen to be, both mentally and physically, amenable to that law; and on what grounds can we assume that he was ever an exception to it? I cannot conceive how those who believe geological changes to have been brought about by causes which are still in operation in our own day, and who make great calls upon time in order to reconcile those causes to the phenomena observed, can, in treating biological phenomena, advocate belief in so great a break in the observed order of the universe as is implied by the special creation of man. Still less willing am I, in the absence of more cogent argument than has ever yet been advanced in support of it, to assent to hypotheses of the separate development of races, which appears to me equally at variance with nature. There can be no doubt that all the existing races of man, whatever their colour and physical peculiarities, have greater affinity to each other than any of them have to the apes, or to any other class of animals. The tendency of progress is from simplicity to complexity, from unity to diversity, and it would be a complete inversion of the order of nature that animals so various as the apes, should independently produce animals so much resembling each other as the races of man. The recognized law that, with certain variations, like begets like, appears to me to negative this assumption as fully as it would do the notion, if it were put forward, that because the horse and some other classes of the mammalia, say the rhinoceros, for instance, have some affinities in their bony structure, therefore the black horse is descended from the African rhinoceros, and the white horse from that of India. Moreover all the races of mankind inter-breed, and I am at a loss to understand how a circumstance like this, which throughout the animal kingdom is regarded as a proof of unity of species, should be discarded in its application to humanity. If, then, it is true that diversity of colour is as old as the very earliest traces of man, and

* "Lectures on Man, his place in Creation, and in the History of the Earth," by Dr. Carl Vogt. Edited by James Hunt, Ph.D.

there is evidence that the several coloured races were inhabitants of distinct continents, which have disappeared through geological changes dispersing and mixing the races, blending the colours and obliterating the traces of their formerly isolated homes, then to the same causes which produced the mixing and the blending, we must also attribute the original separation. According to the view I hold, we must ask for more time and still further geological changes to bring them together again in the primeval cradle of the human race.

Now, to apply this reasoning to the origin of weapons. The only vestiges of the primeval tools of mankind now left to us, are those constructed of stone; others of the more perishable materials have decayed, and their representatives only have remained in some few cases as survivals. In my last lecture I showed how uniform in shape and in development these stone implements are found to be in all parts of the world, whether derived from the northern or southern continents of America, from Siberia, Australia, India, Africa, or the surface soils and river gravels of Europe. This uniformity of shape has been used as an argument that mankind must have independently designed the same forms of tools in various parts of the world, and that under like conditions, like forms will be produced by men, however remotely separated. I am not prepared to deny the possibility of some of these forms having had an independent origin; but if the proof of it is to be based upon the separation of continents, we see how entirely groundless such an argument is when applied to the earliest ages of humanity. For if, as has been conjectured, the races of man may have been dispersed by geographical changes of land and sea, it is obvious they may have carried with them, from some primal source, the art of manufacturing stone weapons, the resemblance of which is far more satisfactorily accounted for by this means* than by supposing such singular and invariable coincidence in design to be the result of independent discovery. As we contemplate man in his lower and lowest conditions, we find the imitative faculty stands out more and more prominently by the absence of those higher qualities which characterize civilized races; and whatever power of originality for the invention of new arts may have been possessed by the earliest inhabitants of the globe, its results appear to have been spread over so vast a lapse of time that it can scarcely be accounted at all as an element in the mental attributes of primeval man.

I now pass to what has been announced as the subject proper of my present communication, viz., the origin and development of metal tools. I use the word *metal* intentionally, in preference to specifying bronze, because, although we have good reason for supposing that in Europe, Egypt, Assyria, and the central parts of

* The fact mentioned both by the Baron de Bonstetten and Dr. Keller, of celts of jade and nephrite having been found in Switzerland, materials which, according to the latest investigations, are not found in the Alps, but must have been imported from the East, proves that intercommunication and barter must have been carried on between distant countries at the time when such weapons were used.—"Recueil d'Antiquités Swisses," par M. le Baron de Bonstetten; "The Lake Dwellings of Switzerland," by Dr. Keller, pp. 56, 68.

America, bronze preceded iron as a material for weapons, it is not so certain that this was the case in all parts of Asia; and in Africa, we know that iron was the first metal employed by the negroes.

Perhaps no subject has given rise to so much difference of opinion amongst archæologists as this question of the origin of metal implements, or has been accompanied with such uncertain results, owing to the great mass of conflicting evidence to be dealt with, and the great doubt which rests upon much of it, whether in regard to the casual mention of the subject in ancient authors, or to the often ill-directed researches of modern times. It would be hopeless in the brief time allotted me on the present occasion, to attempt to throw fresh light on this intricate subject, even if I possessed the materials for so doing. All I shall endeavour to do is, to put together, in as intelligible a form as possible, some of the more salient points upon which archæologists are divided, and trace the continuity observable in passing from the stone to the metal age.

We have already seen, in speaking of the implements of the stone age, a gradual improvement in form and fabrication, developing itself in proportion as the wild animals which were contemporaneous with the first traces of man in Europe, became extinct, partly, no doubt, through the efforts of man himself in exterminating them, and partly, as there seems reason to suppose, owing to an alteration of temperature, rendering the climate unsuited to the constitution and habits of those animals, which therefore migrated by degrees, and the majority of which are now found chiefly, though not exclusively, in arctic regions. Thither they have been accompanied by races of men whose arts and implements show them to be very nearly in a corresponding stage of civilization to the early races, the relics of which are found associated with the same animals in Europe. The simultaneous migration of races of men in the hunting stage of civilization, with the animals, the pursuit of which forms the almost sole occupation of their lives, is well shown in the case of the North American Indians, whose geographical distribution is now almost identical with that of the buffalo. This forms a strong point in the arguments of those who are disposed to attribute all the changes in the world's civilization to the influx and extermination of antagonistic races. But it must be remembered that progress advances in an increasing ratio, and the phenomenon now seen in America and Australia of a highly civilized race constantly fed by steam-communication from the Old World, driving before it and rapidly exterminating other races so vastly its inferior as the Australians and American Indians, is one which could have had no parallel at the early period of which I am now speaking. We must here look for a slower process, though doubtless the operating causes may, to a great extent, have been the same.

The fabrication of stone implements would of itself lead by degrees to a knowledge of the metals which are contained in stones. Thus, for example, I have here a specimen of a stone mace-head from Central America, fig. 2, Plate XXXIII, composed of a nodule of hæmatite partially coated with micaceous iron ore, the particles of which are distinctly visible on its glittering surface. The weight of this imple-

ment being nearly double that of a mace-head composed of ordinary stone, would at once attract the notice of the savage fabricator, and lead him to investigate the uses of metal.

But, as a general rule, races engaged exclusively in hunting, who rarely turn their attention to the ground except to examine a trail or to search for water, would have little opportunity of profiting by the mineral wealth of the soil over which they roamed. Witness the Australians, who have continued for ages in ignorance of the gold and other mines which are now so attractive to Europeans; or the North and South American Indians, and the Esquimaux, amongst whom the art of smelting metal has never been found associated with those races who are in a purely hunting stage of existence; the wrought metals used by such races to point their weapons being invariably derived from civilized sources.

From hunting wild animals, the savage, in the natural sequence of progress, would turn his attention to their capture and domestication, and thus he creeps gradually into the pastoral life, and as the bones of animals under domestication, through want of exercise and good living, become smoother and of finer texture, the experienced anatomist is thereby afforded the means of distinguishing amongst the vestiges of antiquity, the remains of domesticated animals from those derived from the chase, and of observing to what extent the domestication of animals was contemporaneous with other changes in the social condition of the people.* Still, however, in the pastoral state, the barbarian is not necessarily brought in contact with metals; and hence we should expect in many cases to find the traces of domesticated animals associated with people who are still in the stone age. This was notably the case amongst the ancient inhabitants of the Swiss lakes, where the sheep and horse have been found at Moosseedorf, and other lake habitations, which are proved to belong to the stone age, though not in such abundance as in those settlements belonging to the bronze age.†

From the pastoral life, the barbarian, hampered by his flocks and herds, and no longer obliged to wander in search of food, settles down to a more stationary life, and by degrees takes to agriculture. Then, for the first time, he digs into the soil, and becomes acquainted with its mineral treasures. It has been proved by the discovery of quantities of carbonised grains of wheat, lumped together, in the Swiss lake habitations of the stone age, together with the materials for preparing it for food, that a knowledge of agriculture preceded the general employment of bronze in that region,‡ whilst in Britain, and in Denmark also, bronze is almost invariably associated with evidence of domestication and agriculture.

The metals first employed would be those that are most attractive. Copper, in Europe, from the bright colour of its ores, would be noticed

* "Prehistoric Times," by Sir John Lubbock, Bart., F.R.S., p. 147.

† "Prehistoric Times," by Sir John Lubbock, Bart., F.R.S., pp. 142-143. "Results of the Investigation of Animal Remains from the Lake Dwellings," by Prof. Rütimeyer. "The Lake Dwellings of Switzerland," by Dr. Ferdinand Keller, translated by J. E. Lee, F.S.A., F.G.S., pp. 355-362.

‡ "Moosseedorf," Keller, p. 35. "Robenhausen," Keller, p. 40.

more readily than iron, which is often scarcely distinguishable from the soil, and requires greater temperature and more skilled labour to render it available than could be expected of a people emerging out of the savage state. It is not, therefore, surprising that in Europe, copper first, and subsequently its alloy, bronze, should have been employed before iron as a material for weapons. But in those countries where iron is found upon the surface in an attractive form, and in a condition to be easily wrought, we must for the same reason suppose that it would be used instead of copper in the earliest ages of metallurgy.

But implements of pure copper are comparatively rare, bronze being the metal almost invariably found following immediately upon the age of stone, and it is natural to suppose that in the ordinary course of development, an age of pure copper must have intervened between the ages of stone and bronze. Notwithstanding the comparative rarity of copper tools, however, there is reason to believe that this metal was used in a pure state before the discovery of the alloy. According to Professor Max Müller, copper was the metal spoken of by Hesiod and Homer as the material generally employed for weapons in their time.* Mr. Rawlinson, in his "Five Ancient Monarchies," says that the metallurgy of the early Chaldeans was of a very rude character, indicating a nation but just emerging from an almost barbaric simplicity, and that copper often occurs pure.† Copper implements, of a very early form, beaten into shape, occur not unfrequently in Ireland, as may be seen by specimens represented in Class A, Plate XXXII. They have also been found in Mecklenburg and in Denmark, and Klemm‡ says that they occur in Greece, Italy, Spain, Egypt, and Hindustan. At Maurach, in Switzerland, a copper celt was found in a lake dwelling, which Dr. Keller, notwithstanding this circumstance, attributes to the stone age.§ In the lake dwelling of Pescheira, on the lake of Garda, several copper implements were discovered,‖ and in certain localities in Hungary, copper implements are said to be as plentiful as those of bronze.¶ An axe of pure copper was discovered in Ratho Bog, near Edinburgh, under 20 feet of stratified sand and clay, and Dr. Wilson mentions that others have been found in Scotland.** Copper implements occur in Peru, to prove that in the central parts of America also, the manufacture of bronze was preceded by the use of copper in a pure state; and in the ancient mines of Lake Superior we have distinct evidence of a stage of early metallurgy in which copper was used simply as a malleable stone, and beaten out into the form of implements without the aid of any alloy or a knowledge of the process of casting.†† (See figs. 3, 4, 5, and 6, Plate XXXIII.)

* "Science of Language," second series, p. 230.

† "The Five Great Monarchies of the Ancient Eastern World," by George Rawlinson, M.A., vol. i, p. 123.

‡ "Werkzeuge und Waffen," by Dr. Gustav. Klemm, p. 96.

§ Keller, p. 116.

‖ Keller, p. 221, Pl. lxvii.

¶ Keller, p. 218, 219, Pl. lxviii.

** "Prehistoric Man," by Daniel Wilson, LL.D., vol. i, p. 282.

†† "Prehistoric Man," vol. i, pp. 231—279. "Smithsonian Contributions to Knowledge," vol. i, pp. 196—203, from which works the illustrations are taken.

When it is considered that without the admixture of a small portion of alloy of zinc or tin, copper is very difficult to melt, and can only be used by a laborious process of beating into form, and also what a great superiority bronze has over copper as a cutting material, whilst at the same time the process of fabrication is actually in some degree facilitated by the addition of tin, it is not surprising that on the first discovery of the advantages of this mixture, all the old implements of copper, wherever procurable, should have been taken to the melting-pot for conversion into bronze, and we should thus be left with such scanty evidence of the existence of an age of copper.

Up to this point we meet with no difficulty in supposing that the use of metal may have been at first adopted by many nations independently, without intercourse one with another. But when we find in both hemispheres of the globe a very wide diffusion of weapons of bronze, consisting of a mixture of the same metals, which, though varying slightly in its proportions, as we shall afterwards see, is nevertheless, for the most part, constant in its adherence to a standard of about nine parts copper to one of tin in all parts of the world, the question arises whether the knowledge of this mixed metal could have been arrived at independently in different countries, or whether it must have been diffused all over the universe from a common source. It is true that copper and tin minerals are sometimes found in the same locality, as, for instance, in Cornwall, the locality which, from the remotest time up to the present, has afforded the most plentiful supply of both metals perhaps in the world. We have evidence, also, that in ancient copper mines, fire was employed by the miners for softening the metal and detaching it from the matrix,* and it is, therefore, highly probable that the admixture of the two metals occurring so close together, and a knowledge of the advantages accruing therefrom, may have been brought about accidentally in the process of mining.† But this connection of the metals in a state of nature is not common, and in those countries, such as Denmark and Scandinavia, where bronze implements occur, and in which neither metal is found native, it is most improbable that the inhabitants should have discovered the merits of these particular ingredients, unless they had derived the knowledge of it from without.

Hence we find archæologists as much divided in their opinions upon what I may call the monogenesis or polygenesis of bronze as biologists and anatomists are upon the monogenesis or polygenesis

* "Prehistoric Man," vol. i, 253.

† Since writing the above, Sir John Lubbock has published in an Appendix to his second edition of "Prehistoric Times," letters from Dr. Percy, and from Messrs. Jenkin and Lefeaux, highly experienced assayers, expressing their opinions upon the theory of M. Wibel, that the ancient bronze was obtained, not by the fusion of copper and tin, but directly from ore containing the two metals. They are unanimously of opinion that this could not have been the case, none of the ores containing naturally a mixture of the metals in proper proportions. Although the opinions of these gentlemen appear decisively to negative the possibility of ancient bronze having been habitually produced for commercial purposes in this manner, they do not appear to me to discredit the supposition that the first imperfect knowledge of the mixture may have been brought about accidentally in the manner I have described.—A. L. F.

of the human race. The same question repeats itself again and again in dealing with the vestiges of the early history of man, and we may therefore divide the consideration of this question of the origin of bronze under pretty nearly the same heads to which I have adverted when speaking of the distribution of races, and of the age of stone. The questions to be considered may be numbered as follows:—1stly. That bronze was spread from a common centre by an intruding and conquering race, or by the migration of tribes; 2ndly. That the inhabitants of each separate region in which bronze is known to have been used, discovered the art independently, and made their implements of it; 3rdly. That the art was discovered, and the implements fabricated, on one spot, and the implements disseminated from that place by means of commerce; 4thly. That the art of making bronze was diffused from a common centre, but that the implements were constructed in the countries in which they are found.

Amongst the advocates for the first hypothesis, viz., introduction by the intrusion of fresh races, are to be found chiefly the Scandinavian archæologists, amongst whom may be especially mentioned Professors Worsaae, of Copenhagen,* and Nilsson, of Stockholm. Both metals are foreign to the soil of Denmark, and must, therefore, have been imported. In the graves, bronze weapons are in Denmark invariably found with burials by cremation, while those of the stone age are by inhumation, the former being recognised in an early stage of civilization as a later process than burial by inhumation. Bronze is here markedly associated with traces of agriculture, the evidence of which is wanting in the stone age. The age of bronze, it is asserted by these antiquaries, was ushered in in Denmark by the employment of implements showing the highest perfection of art, and at a later period, when they are associated with weapons of iron, they are inferior in the quality of their workmanship. The weapons of bronze have remarkably small handles, denoting a smaller race, and hypothetically an eastern origin, small handles being to this day the characteristic of weapons from India. Some of the bronze spear-heads in Denmark have been found with nails driven into them, a practice which still exists in India, each nail denoting a victim; and in the Asiatic Islands the custom of boring a hole in the weapon for each victim is found to the present time.† The peculiar ornamentation so often found on the bronze swords of Denmark, known as the spiral ornament, is said, though I think erroneously, to be of Phœnecian origin. To these and other arguments for the introduction by intruding races, Professor Nilsson adds, that in the countries of the north, where bronze implements are found in greatest abundance, the graves in which they occur are usually situated in groups, proving that bronze was introduced, not by isolated individuals, merchants, or travellers, but by tribes or colonies more or less numerous, occupying especial tracts of country.

The theory of race-origin is also not without its adherents in this

* "The Primeval Antiquities of Denmark," by J. J. A. Worsaae, pp. 24, 40—45.

† The custom of making a mark upon the weapon for each victim slain, is one of very usual occurrence among savage people.

country. Dr. Thurnam, who has excavated a large number of barrows in the south of England, divides them—as, indeed, they have been divided by former antiquaries—into several classes, amongst which we may chiefly distinguish two principal types, viz., the long and the round barrows. The former he attributes to the stone age, containing usually implements of that material, whilst implements of bronze are almost invariably found in the round barrows. He also gives it as the result of his researches, extending over some years of exploration—and Canon Greenwell, in so far as his experience of long barrows in the north of England goes, confirms the statement—that, the long barrows are generally associated with dolichocephalic, or long skulls, whilst in the round barrows brachycephalic, or round skulls, are found, thus leading to the supposition that the long-headed people of the stone age who erected the long barrows may have been succeeded by another race with round heads importing bronze, and burying their dead in round barrows. But after having heard Dr. Thurnam's last papers on this subject, read before the Society of Antiquaries and other societies,* I confess, although he has no doubt established a sequence, that he does not appear to me to have determined a clear line of separation between the two classes of interments; the long barrows pass by intermediate links into the round ones, and the long skull, although no doubt it may be considered characteristic of an earlier period, and therefore connected with an earlier form of barrow, also passes by gradations into the round skull, the variations of form being considerable. Then with respect to the implements; although the absence of bronze in the long barrows of the earlier period appears to be determined, yet it is notorious to all those who have paid attention to the subject—and is not by any means denied by the learned antiquaries whose names I have mentioned—that the transition from stone to bronze in this country was gradual, and extended over a long period, flint weapons being found in nearly all the barrows of the bronze age in such positions as to show they were used contemporaneously by the same people; and from discoveries which have been made both by myself and others,† there seems good reason to suppose that flint weapons continued to be used by some of the inhabitants of this country even during the Roman era. This distinction of long heads in long barrows, and round heads in round barrows, is one so easily remembered, that it is liable on this account, perhaps, to receive greater attention than it really deserves as a criterion of race. The difficulty of distinguishing in all cases the primary from the secondary interments in the barrows—it being an established fact that these barrows were used as places of burial by successive generations, and even perhaps by successive races, including also the Anglo-Saxons—the possible distortion of

* "Ancient British Barrows," by John Thurnam, Esq., M.D., F.S.A., "Archæologia," vol. xlii. "Crania Britannica," by J. B. Davis, M.D., F.S.A., and John Thurnam, M.D., F.S.A.

† "On some Flint Implements found associated with Roman Remains in Oxfordshire and the Isle of Thanet," by Col. A. Lane Fox, "Quarterly Journal of the Ethnological Society," April, 1869.

some of the crania by time and pressure, and the other facts of the case, as I believe I have correctly stated them, are, I think, sufficient to justify us in withholding for the present our entire acceptance of the theory of the introduction of bronze into this country by intruding races, as drawn from any evidence derived from the graves.

From amongst those who have advocated the totally independent origin of bronze, the opinion of Professor Daniel Wilson may be selected, as affording a most ingenious argument derived from an analyses of the metals.* He quotes some experiments conducted by Dr. George Pearson, and communicated by him to the Royal Society of London of 1796, to ascertain the results of various proportions of the ingredients of tin and copper in bronze. "Having fused these "metals in various united proportions, commencing with 1 part of tin "to 20 parts of copper, which produced a dark-coloured bronze, he "reduced the proportion gradually to 15 parts of copper to 1 of tin, "when the colour was materially affected, and the red copper hue "was no longer seen, but an alloy of greater strength was produced. "The experiments were continued with 12, 10, 9, 8, and 7 parts of "copper to 1 of tin, and when the last fusion of the metals was tested, "increased hardness and brittleness of the metals became very appa-"rent. The same characteristics were still more marked on succes-"sively reducing the proportions of copper to 6, 5, 4, and 3; and "when an alloy was made of 2 parts of copper to 1 of tin, it was, "according to Dr. Pearson's report, as brittle as glass."

From the result of these experiments we see that the best average proportions of about 9 parts of copper to 1 of tin, would invariably show itself by a practical experience in the use of these ingredients, and it is therefore unnecessary to assume that these particular proportions, when found in the bronzes of different countries, must necessarily have been communicated.

Dr. Wilson then proceeds to give the results of analyses of ancient bronzes discovered in Europe, America, and elsewhere, contained in the accompanying tables. And he concludes his observations on the subject as follows:—

"From the varied results which so many independent analyses dis-"close, varying, as they do, from 79 to 94 per cent. of copper, or more "than the total amount of the supposed constant ratio of tin, besides "the variations in the nature, as well as the quantity of their ingre-"dients" (a proportion of lead will be seen in some of the analyses of European bronzes, the small proportion of iron being probably accidental), "it is abundantly obvious that no greater uniformity is "traceable than such as might be expected to result from the "experience of isolated and independent metallurgists, very partially "acquainted with the chemical properties of the standard alloy, and "guided for the most part by practical experience derived from suc-"cessive results of their manufacture." The comparison of the two tables here given from Professor Wilson's work also shows a smaller average amount of tin in the American bronze than in that of ancient Europe.

* "Prehistoric Man," by Daniel Wilson, LL.D., vol. i, p. 308.

ANALYSES OF ANCIENT EUROPEAN BRONZES.

			Copper.	Tin.	Lead.	Iron.
1 Lituus	Lincolnshire	Dr. G. Pearson, F.R.S., Phil. Trans.	88·	12·		
2 Anglo-Roman-Patellæ	.. ..	Ditto ditto	86·	14·		
3 Spear-Head	.. ..	Ditto ditto	86·	14·		
4 Scabbard	Danish?	Ditto ditto	90·	10·		
5 Axe-Head	Ireland	Ditto ditto	91·	9·		
6 Axe-Palstave	Cumberland	Ditto ditto	91·	9·		
7 Axe-Head	.. ..	Ditto ditto	88·	12·		
8 Bronze-Vessel	Cambridgeshire	Professor Clark, M.D.	88·	12·		
9 Sword	France	Mongez M. de l'Institut	87·47	12·53		
10 Caldron	Berwickshire	G. Wilson, M.D., Prehist. Ann. Scot.	92·89	5·15	1·78	
11 Sword	Duddingstone	Ditto ditto	88·51	9·30	2·30	
12 Kettle	Berwickshire	Ditto ditto	88·22	5·63	5·88	
13 Axe-Head	Mid-Lothian	Ditto ditto	88·5	11·12	0·78	
14 Caldron	Duddingstone	Ditto ditto	84·8	7·19	8·53	
15 Palstave	Fifeshire	Ditto ditto	81·19	18·31	0·75	
16 Sword	Ireland	Professor Davy, Prehist. Ann. Scot.	88·63	8·54	2·83	
17 Sword	.. ..	Ditto ditto	83·50	5·15	8·35	3·
18 Sword	Thames	J. A. Phillips, F.G.S, &c.	89·69	9·58	..	0·33
19 Sword	Ireland	Ditto	85·62	10·02	..	0·44
20 Celt	.. ..	Ditto	90·68	7·43	1·28	
21 Axe-Head	.. ..	.. ..	90·18	9·81		
22 Axe-Head	.. ..	Ditto	89·33	9·19	..	0·33
23 Celt	.. ..	Ditto	83·61	10·79	3·20	0·58
24 Celt	King's County, Ireland	Dr. Donovan, Chem. Gazette	85·23	13·11	1·14	
25 Drinking-Horn	.. ..	.. ..	79·34	10·87	9·11	
26 Bronze-Vessel	Ireland	Gibbon, U. S. Mint	88·	12·		
27 Wedge	.. ..	Ditto	94·	5·9	..	0·1

ANALYSES OF ANCIENT AMERICAN BRONZES.

			Copper.	Tin.	Iron.
1 Chisel from Silver Mines	Cuzco....	Humboldt.....	94·	6·	
2 Chisel „ „	Cuzco....	Dr. J. H. Gibbon	92·385	7·615	
3 Knife „ Grave.....	Atacama..	J. H. Blake, Esq.	97·87	2·13	
4 Knife.....	..	Ditto	96·	4·	
5 Crow-Bar	Chili	Dr. T. C. Jackson	92·385	7·615	
6 Knife.....	Amaro...	Dr. H. Croft....	95·664	3·965	0·371
7 Perforated-Axe.....	..	Ditto	96·	4·	
8 Personal Ornament.....	Truigilla.	T. Ewbank, Esq.	95·440	4·560	
9 Bodkin from Female Grave	..	Ditto	96·70	3·30	

This argument, however, is defective when taken to determine the question of the origin of bronze in favour of independent discovery, for as we have already seen, in speaking of the stone age,—and I have endeavoured to show that it is a peculiarity observable in the works of all savage and barbarous races,—that being devoid of rule or measure, and having very imperfect means of securing adherence to a uniform standard, their productions are characterized by incessant variations, even in cases where the first idea is known to have been derived from a common source. The variations here shown to exist in the composition of bronze are no greater than are capable of being accounted for by the universal prevalence of a law of variation, resulting from many causes, and amongst others from want of precision, and carelessness, which is a defect common alike to all tyros in their art, whether ancient or modern. It is a fault we have many of us to complain of almost daily in our cooks. A batter pudding is composed of milk, flour, and eggs, in proper proportions, but a careless cook will constantly vary her proportions, and will fail in adjusting her quantities to the total amount; but we must not, on that account, assume that each cook has invented the art of making batter puddings independently. So, in like manner, it is quite consistent with the facts observed even in America, to suppose that the first knowledge of bronze, and of those many features in the civilization of the Mexicans and Peruvians, which present such striking analogies to the civilization of Egypt, may have been originally communicated by some casual wanderer or some shipwrecked cast-away from the then centres of Eastern culture (for the theory of geographical changes is, of course, out of the question when speaking of the origin of bronze), and that they have varied in their development on American soil no more than might naturally be expected from their introduction to an entirely new and partially civilized race. Such an assumption, though difficult to account for, and wanting in evidence, is more in accordance with the well-known traditions of the Mexicans and Peruvians, who attribute their civilization to the advent of a god; or with that of the natives of Nootka Sound, on the north-west, who state that an old man entered the bay,

in a copper canoe, with paddles of copper, and that the Nootkans by that means acquired a knowledge of that metal.

As illustrations of the modern metal work of the natives of Nootka Sound and its neighbourhood, several examples are given in Plate XXXIII, figs. 7 to 11. Figs. 7 and 8 represent two sides of an iron dagger in the Museum of the Royal United Service Institution. The ornamentation on the handle is that of the natives of the country, but the workmanship of the blade, which is ribbed on one side, appears to indicate foreign manufacture. Figs. 9 and 10 are two sides of a copper dagger of the same form; this specimen is now in the Belfast Museum, in which it was deposited in the year 1843, by Mr. A. Thompson, who brought it from the north-west coast of America, and described it as having been fabricated by the Flathead Indians; it is undoubtedly of native workmanship; in both these weapons one side of the blade and handle is concave, the other convex, a form which appears to denote that it was originally taken from some similar weapon of bone or cane. The nearest approach to the form of this weapon in bone, that I am aware of, is that of the Indian kandjar, a figure of which was given in my first lecture on Primitive Warfare, Plate LII, fig. 63. This weapon has also one concave and one convex side, derived from the natural curvature of the bone out of which it is made.

But putting aside American civilization, which, it must be admitted, does in the existing state of our knowledge present great difficulties in the way of those who advocate the theory of a common origin for bronze, and turning our attention to the eastern hemisphere, we find the evidence on this point more satisfactory. We may observe, in the first place, that the area over which bronze has been used for implements appears, in so far as we have at present been able to trace it, to be continuous, extending over the greater part of Europe, Egypt, Assyria, and some parts of Siberia, India, and China, from which latter country some few bronze weapons have lately been added to the British Museum. Mr. Theobald, of the Geological Survey of India, also mentions in a paper read to the Royal Asiatic Society,* that bronze axes are found in the valley of the Irrawady, where they are held in such veneration as rarely to be procurable; and Sir Walter Elliot has shown me some bronze implements which he found deep beneath the soil in cutting a canal in the valley of the Ganges. Bronze is wanting in Africa; in America, with the exception of Peru and Mexico; in the north of Sweden and Norway, and, I believe, in the greater part of the northern districts of Russia and Siberia, though with regard to Russian and Siberian bronzes, our information is still very deficient. And here I may observe that I speak only of bronze as applied to tools and weapons; its use for other purposes may have been introduced at any subsequent period of the world's history; but the presence of a bronze weapon implies either total ignorance, or at least an imperfect knowledge of the means of hardening the more useful metal for this purpose,—iron.

Those who, wish for more detailed information as to the evidence

* "Journal of the Asiatic Society of Bengal," vol. xxxiv, p. 126. July, 1865.

upon which the succession of the stone, bronze, and iron ages has been determined, would do well to refer to Sir John Lubbock's remarks upon this subject, in *Prehistoric Times*. It may, however, be useful to enumerate briefly some of the chief points which have been adduced in support of the opinion that the employment of these materials corresponds to successive stages in the development of civilization in Europe. 1stly. Not only do the Roman writers mention iron as being the metal used by them in their time, but they also speak of its employment by the barbarian nations of the north, with whom they came in contact, and the word "ferrum," *iron*, was with the Romans synonymous with sword. 2ndly. Although numerous finds of iron implements of the Roman period have been discovered in various parts of the world, there has been no authentic and undoubted instance of a weapon of bronze having been found associated with them, or with Roman pottery or coins. 3rdly. Bronze implements are most abundant in Denmark and Ireland, countries which were never invaded by Roman armies, whilst they are exceedingly rare in Italy. 4thly. The ornamentation of the bronze implements is not Roman, but pre-Roman in character. 5thly. On the other hand, the numerous finds of bronze weapons which have been discovered have never been associated with iron, except in cases where the nature of the iron implements show them to have belonged to a period of transition. 6thly. The pottery associated with bronze-finds is superior to that found with stone implements, but inferior to that of the iron age, and the potter's wheel was unknown during the stone and bronze ages. 7thly. Silver is found associated with iron, but rarely if ever with stone or bronze. 8thly. No coins or inscriptions of any kind have been found with bronze implements. 9thly. In the Swiss lakes, settlements associated with stone and bronze have been found near each other, as for instance Moosseedorf and Nidau, 15 miles apart; in the former, bronze is entirely absent, in the latter, it was used, not only for articles of luxury, such as might denote a more wealthy class, but also for implements of common use, such as fish-hooks, pins, &c.; it is improbable that so marked a contrast in the civilization of two settlements so close to each other should have existed during the same period. 10thly. The implements and ornaments of the bronze-finds are more varied in form, showing an advance in art upon those appertaining to the stone age. 11thly. The bronze-finds are marked by an increase in the number of domesticated animals, and an entire absence of some of the wild animals of the earlier period, and they are also more clearly associated with traces of agriculture. 12thly. In the Danish peat bogs, successive strata are found overlying each other, denoting changes in the vegetation of the country; in the lowest and earliest, are found the remains of pine trees, which now are foreign to the soil; above which are strata, in which oak was the prevailing tree, and at the present time the oaks have been superseded by beeches. These successive strata correspond in a general way to successive stages in the civilization of the inhabitants; in the pine-bearing strata, implements of stone are found; with the oak trees, implements of bronze, and higher up, implements of iron. It has also been attempted to trace a somewhat similar succession of periods in the gravels and

alluvium of the torrent of Tinière, in Switzerland; but the evidence in this case is not considered so satisfactory as in that of the Danish peat bogs.

In Chaldea, the transition from stone to bronze has been traced by the relics found in the soil, iron being then used only in small quantities, and chiefly for ornaments, as amongst the Ancient Britons in the time of Cæsar.* In Egypt, where both bronze and iron weapons have been found in the tombs, the transition from bronze to iron is marked by the colour of the weapons in the paintings, and dates, according to Sir Gardener Wilkinson, about B.C. 1,400. Hesiod speaks of an age of copper, when the black iron did not exist. Homer also alludes frequently to copper or bronze implements, and when iron is mentioned always speaks of it as requiring much time and labour to fabricate it. Then we have the well-known passage from Lucretius, so often quoted in reference to this subject, in which the three ages of stone, bronze, and iron are mentioned;† and Strabo mentions the Lusitanians as being armed partly with copper or bronze weapons.‡

Many other quotations might be given from ancient authors to prove that the existence of a bronze age preceding the use of iron was known to the ancients, but I will not occupy your time further with this part of the subject, seeing that others far more competent to deal with it than myself have failed to derive much information of value from this source. There is often considerable difficulty in determining the exact meaning of the writers, when speaking of the material of which weapons are composed, the same word being sometimes used to express copper, bronze, and iron. In fact it may, I think, safely be said that notwithstanding the large amount of useful information that may be obtained from the study of the early writers, there is no more fruitful source of error than the attempt to apply ancient history and tradition to the elucidation of prehistoric events. Modern science, and our fuller appreciation of the value of evidence, has thrown far more light on prehistoric times than ever fell to the lot of the ancients; and it is for us, therefore, to correct their errors, and not to be misled by them.

Professor Max Müller, in the second series of his "Science of Language," has, however, drawn some important conclusions on this subject, from the etymology of words representing metal, of which it may be useful here to give a brief abstract. Quoting Mr. E. B. Tylor's work on the Anahuac, he says: The Mexicans called their own copper or bronze *Tepuztli*, which is said to have meant originally, hatchet; the same word is now used for iron, which the Mexicans first became acquainted with through their intercourse with the Spaniards. *Tepuztli* then became a general name for metal, and when copper had to be distinguished from iron, the former was called red *Tepuztli*, and the latter black *Tepuztli*. The conclusion, he says, which we may draw from this,

* "Five Ancient Monarchies," vol. i, p. 120.

† Arma antiqua, manus, ungues, dentesque fuerunt
Et lapides, et item sylvarum fragmina rami,
Posterius ferri vis est, ærisque reperta,
Sed prior æris erat, quam ferri cognitus usus.—V. 1282.

‡ Strabo, b. iii, c. iii, 6.

viz., that Mexican was spoken before the introduction of iron into Mexico, is one of no great value, because we know it from other sources; but applying the same line of reasoning to Greek, he says—here, too, *chalkós*, which at first meant copper, came afterwards to mean metal in general, and *chalkeús*, originally a copper-smith, occurs in the Odyssey in the sense of a blacksmith, or worker of iron. What does this prove? It proves that Greek was spoken before the introduction of iron. The name for copper is shared in common by Latin and the Teutonic languages, *æs*, Latin; *aiz*, Gothic; *êr*, old high German; *erz*, modern German; *âr*, Anglo-Saxon; and the same word is represented in our English word *ore*. But the words specifically used for iron, differ in each of the principal branches of the Aryan family. At the same time the words originally representing copper come to be used for metal in general, and in some cases for iron. In Sanskrit *ayas*, which is the same word as *æs*, came to be used for iron, a distinction being made between dark *ayas* or iron, and bright *ayas* or copper. *Æs* in Latin, and *aiz* in Gothic, came to be used for metal in general, but was never used for iron. *Aiz*, however, according to Grimm, gave rise to the Gothic word *eisarn*, meaning iron. In old high German *eisarn* is changed into *îsarn*, later to *îsan*, and lastly to the modern *eisen*, while the Anglo-Saxon *îsern* is converted into *îren*, and ultimately to *iron*. The learned Professor sums up his researches on this subject as follows:—"We may conclude," he says, "that Sanskrit, Greek, "Latin, and German were spoken before the discovery of iron, that "each nation became acquainted with that most useful of all metals "after the Aryan family was broken up, and that each of the Aryan "languages coined its name for iron from its own resources, and "marked it by its own national stamp, while it brought the names for "gold, silver, and copper from the common treasury of their ancestral "home."*

These remarks point to a very remote period, and to an Aryan origin for the first knowledge of copper and bronze, but on the other hand much has been written in favour of a Semitic origin, especially by Professor Nilsson, who believes that he has discovered traces of that people even on the coast of Norway.

The employment of war chariots, which are known to have been used by the Britons, and vestiges of which have been found in their graves, imply, it is said, Semitic influence. Much stress is also laid upon the resemblance of some of the ornaments found on the Danish and other bronzes to those in use by the Phœnicians. More especially the spiral ornaments which Professor Nilsson traces to that source, through the engravings on weapons in the bronze age tumuli. Against this, however, it may be urged that the spiral ornament has a very wide distribution, extending over modern Africa, ancient Egypt, Greece, China, New Guinea, Mexico, and South America, and even to New Zealand and the Asiatic Isles. In illustration of this I have arranged upon Plate XXXIII a series of illustrations of spiral ornaments from various countries, showing how universally it is distributed over the globe.

* Max Müller, "Science of Language," 2nd series, pp. 229 to 237.

Fig. 12, is from a New Zealand canoe in my collection; Fig. 13, from a club brought from New Guinea by the Commander of the "Rattlesnake," in 1849, and now in my collection; Fig. 14, from China; Fig. 15, from ancient Egypt; Fig. 16, from Greece; Fig. 17, from a Danish bronze sword; Fig. 18, from an Irish bronze brooch in my collection; Fig. 19, from the Swiss lakes, figured in Dr. Keller's work; Fig. 20, an iron ornament in my collection from Central Africa; Fig. 21, an iron ornament on a club, from the Bight of Benin, West Africa, in the Christy Collection; Fig. 22, an ornament on a wooden arrow-head, in the Christy Collection, probably from one of the Melanesian isles; Fig. 23, from Hallstatt; Fig. 24, a cane arrow-head from the Amazons, South America; Fig. 25, a spindle whirl from Mexico; Fig. 26, on a bronze shield from the Caucasus; Fig. 27, an ornament on a bracelet from Hindustan, in the British Museum; Fig. 28, an ornament carved upon the stones of New Grange, in Ireland; Fig. 29, from a New Zealand canoe. Compare the two last figures with Fig. 30, a stone weight in my collection lately fished up on the coast of Kent, whilst dredging for whelks; the ornamentation so closely resembles the New Zealand pattern, and at the same time that of the stone carvings of the European tumuli, that considering the circumstance of its discovery, it is purely a matter for conjecture whether it is to be referred to the antiquities of this country, or has been dropped overboard by some vessel returning from our South Pacific colonies. We see from these examples that the spiral ornament cannot be regarded as belonging exclusively to any one race; it is a contrivance derived simply from the coil of string, the source from which, and also from straw plaiting, nearly all barbaric ornamentation had its origin; it is a proof merely of barbaric origin, an evidence of continuity from the earliest periods of art.

Mr. Franks in his remarks at the Paris Meeting of the International Congress of Prehistoric Archæology, has summarily disposed of the question of Phœnician ornamentation, by observing that the Phœnicians were copyists, taking their style from Egypt, Greece, or Rome, according to the fashion of the period, and that in point of fact a Phœnician style of art has never existed.

Amongst those who have upheld the theory of the origin of bronze from Phœnician sources, may be mentioned Mr. Howorth, in a paper lately published in the sixth volume of the "Transactions of the Ethnological Society;" and Sir John Lubbock, though not committing himself to the same view as regards the origin of bronze, has nevertheless been at the pains of ably defending the ancient authors who speak of Phœnician intercourse with Britain from the attacks made upon them by Sir George Cornewall Lewis.

This being the existing state of our knowledge in regard to the introduction of bronze, and the variety of opinion on the subject being, as we have seen, considerable, the task before us will be to ascertain as far as may be possible from the implements themselves, the history of their origin, by examining carefully their construction in the various regions in which they occur, and by tracing the geographical distribution of those details of form which show evidence of connection, there-

by to determine, if possible, the sources from which they were derived. Whatever degree of veracity we may be disposed to attribute to early history, we must at least admit that the implements have this advantage over written testimony of any kind, that they cannot intentionally mislead us. If we draw wrong inferences from them the fault is our own. We shall find the evidence very fragmentary as yet, but sufficient to prove that it affords a valuable source of information whenever sufficient materials are collected to enable us to work out the problem to its legitimate ends.

On the present occasion I propose to confine my remarks to showing, by means of the accompanying table (Plate XXXII), the distribution of some of the commoner varieties of the copper and bronze celt, an instrument which, like its prototype in stone, appears to have been employed both as a tool and weapon for all the various purposes to which it was capable of being turned, and to have been used not merely as a hatchet and battle-axe, but also to have been sometimes hafted on the end of a straight handle, to be used as a spud or crowbar, and even perhaps, as some of the forms appear to indicate, as a spade in tilling the ground.

The table is arranged upon the same plan as Plate II of my last lecture, and is intended to serve as a continuation of Plate I of the same lecture, showing a further development of the same weapon. The successive developments are arranged in order by classes from left to right; the several localities are separated by horizontal dotted lines, by means of which are seen the various types prevalent in each locality, in so far as I have been able to obtain drawings from published sources; there can be no doubt, however, that the table is still very imperfect, and that considerable additions may be made to it hereafter. On the left, in Class A, will be found celts with convex surfaces, identical in form to those constructed of stone, the relative antiquity of which is shown by their being almost invariably of pure, or nearly pure copper. It has been suggested that this form may have been adopted on account of its being more easily produced by beating the copper, and that its resemblance to the stone celts is not necessarily a proof of age; but there is no reason why Class B should not be as easily formed as Class A by this means, and many are so formed, as may be seen in the table. Moreover, Fig. 3a is a *bronze* celt of the earlier form, taken from *Prehistoric Times*, and as this must have been cast in a mould, its peculiar shape can only be accounted for by supposing it to have been constructed in imitation of the stone celts. In passing from Class B, a gradual development of form may be traced, commencing with a slight stop or ridge across, and rudimentary flanges along the side of the shaft of the blade, developing in size and improving in form, no doubt, as the art of casting bronze became gradually perfected.* These stops and flanges are at first

* Sir Richard Colt Hoare found four of these celts in the Wiltshire barrows, with rudimentary flanges along the side edges of the blade that had been formed by beating, and similarly formed flanges have also been noticed upon celts from Ireland, thereby leading to the supposition that Class B may have been converted into Class D in this way, before the casting process was applied to the formation of the flanges.—A. L. F.

raised on the surface of the blade, but by degrees, the same purpose is effected by sinking a groove in the blade, to receive the handle, thereby economising the metal, and producing a more symmetrical form; the flanges were at the same time bent over, and ultimately cast with a cavity on each side to receive the handle, and obviate the necessity for binding on the celt with thongs. This led by degrees to the ultimate perfection of the weapon, by the introduction of the socket type, which is associated with weapons of iron, and is sometimes itself constructed of that metal.

The order of development here adopted is in the main that followed by Sir William Wilde, in his catalogue of the Museum of the Royal Irish Academy, but I have omitted all mention of branch varieties, as they do not serve my purpose of illustrating the continuity of development, though they are valuable in showing the connection between localities.

Although the course of development appears to have followed the order here indicated, it is not unlikely the earlier forms may have continued in use, and may even have continued to be constructed at the same time as the later forms. The earlier and less complicated types being easier of construction, and being equally serviceable for some purposes, would continue to be made, in the same way that smooth-bores and rifle barrels, row boats, sailing-vessels, and steam-packets, continue to be used simultaneously in our own time.

The progress of development of this weapon will be better understood by a detailed reference to the figures.

Reference to the Figures in Plate XXXII.

COPPER, BRONZE, AND IRON CELTS.

Class A.—Copper celts from various localities, having convex surfaces, in form resembling those of stone.—Figs. 1, 2, and 3, from Ireland, *in my collection*.—Fig. 3a, a bronze celt of the same form, from Le Puy, France, *Prehistoric Times*, *p.* 27.—Fig. 4, copper celt found at Blengow, Mecklenberg Schwerin Museum, *Horæ Ferales*.—Fig. 5, copper celt from the lake dwellings of Sipplingen, Switzerland, found embedded in a coating of clay (mould?). See *The Lake Dwellings of Switzerland, by Keller*, translated by J. E. Lee, *p.* 121, *plate* xxix—Fig. 6, copper celt found in an Etruscan tomb, and now in the Berlin Museum. See *Catalogue of the Royal Irish Academy, bronze*, *pp.* 367, 395.

Class B.—Copper and bronze celts from various localities, having flat concave sides, and a rectangular cross section, showing a gradual enlargement of the cutting edge.—Figs. 7 to 12, copper celts from Ireland, *in my collection* showing a gradual enlargement of the cutting edge.—Figs. 13, 14, 15, ditto, *ditto* of bronze, the sides more concave, and the cutting edge more expanded.—Fig. 16, bronze celt, of similar form, from Denmark (*Afbildninger af Danske Oldsager og Mindesmærker ved A. P. Madsen, Hefte* iii, *Fig.* 1).—Fig. 17, copper celt from Steinfurt, in the collection of Professor Dieffenbach, at Friedberg, *Lindenschmit, Plate* 3.—Fig. 18, ditto of copper, found near Mainz, Museum of

Journal R U S Institution
Vol 13

TABLE SHEWING THE DEVELOPMENT & DISTR

SCALE _ ONE

A. B. C. D.

GT BRITAIN & IRELAND

FRANCE

SPAIN & PORTUGAL

DENMARK

GERMANY

SWITZERLAND

HALLSTATT AUSTRIA

ITALY

HUNGARY

REFERENCE.

Copper

Bronze

Iron

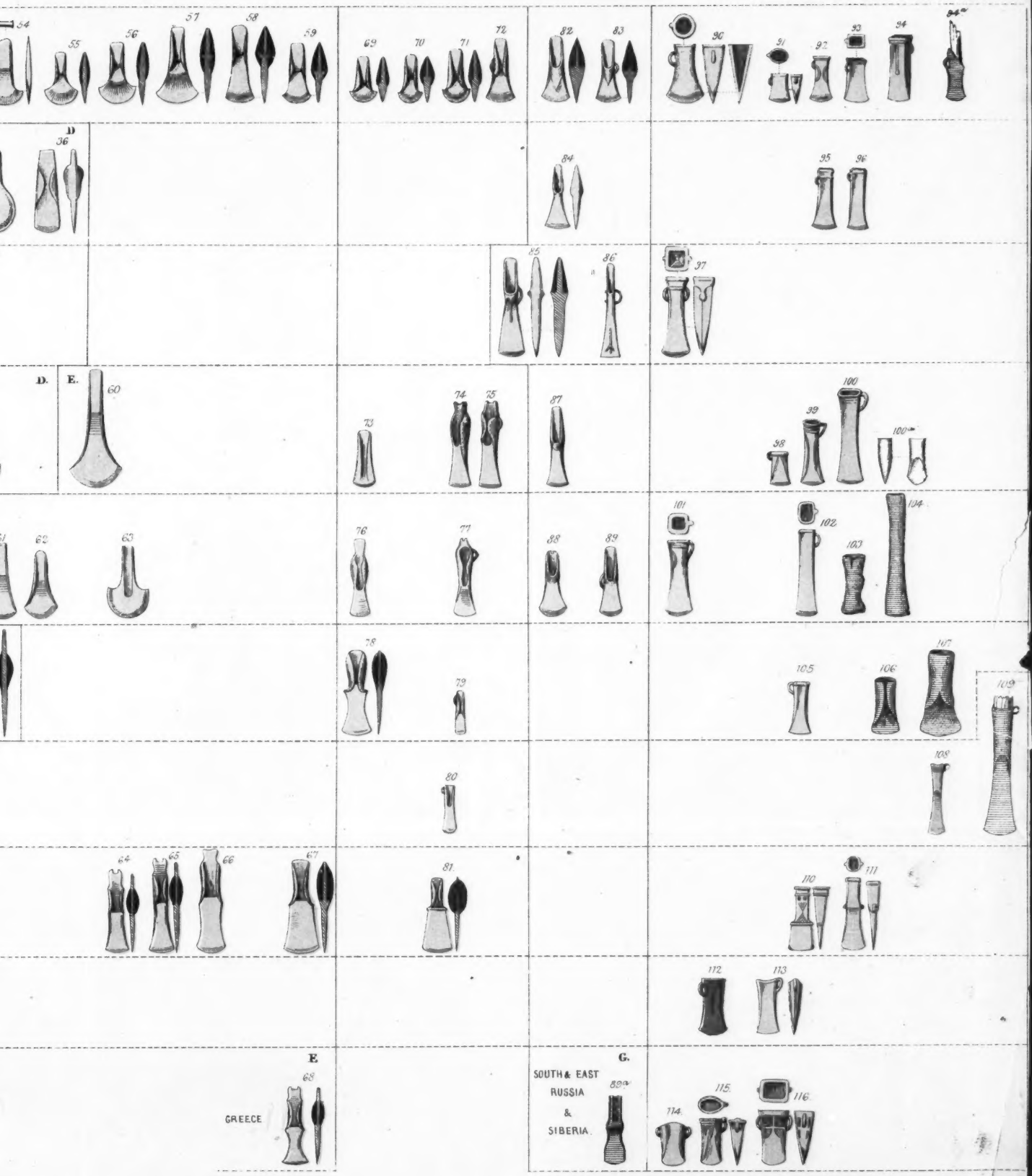
GREEK ISLANDS.

VILNA RUSSIA.

STRIBUTION OF COPPER, BRONZE & IRON CELTS.

E _ ONE TENTH.

E. F. G. H.



Vincent Brooks Day & Son lith.

Mainz, *Lindenschmit*, *Plate* 3.—Fig. 19, the same form of bronze from near Mainz, *Lindenschmit*.—Fig. 20, the same form of bronze from Italy, *British Museum*.*—Figs. 21, 22, 23, the same form of copper from Hungary, *Keller*, *p.* 219, *Plate* lxviii.—Figs. 24, 25, 26, similar forms of bronze, with rectangular holes, from the Island of Thermia, Greek Archipelago, *British Museum*.

Class C.—Bronze celts of the same outline as Class B, but having a cross ridge or stop on both faces, to prevent the blade from burying itself in the handle.—Figs. 27, 28, bronze celts from Ireland, *in my collection;* this form is common to the British Isles.

Class D.†—Bronze celts, having four longitudinal ridges or flanges, one on each edge, but no cross stop. The flanges are for the purpose of fixing the blade in a bent handle; they exhibit a gradual development of the flange, and an expansion of the cutting edge, which latter takes a semi-circular, and in some cases nearly a circular form.—Figs. 29, 30, from Ireland, *in my collection* showing front view and section.—Fig. 31, from Versailles, *in my collection*, with section.—Fig. 32, from France. See *Matériaux pour l'Histoire de l'Homme*, with side view.—Fig. 33, from Loyette, Department of Isere, from *Horæ Ferales*, front view.—Fig. 34, from the South of France, *British Museum*, the blade very circular.—Fig. 35, from Alps, in Ardèche, *British Museum*, the circular form of the blade still more developed. This form appears peculiar to the neighbourhood of the Rhone.‡—Fig. 36, from France; see *Matériaux*, *&c.*, with side view.—Fig. 37, from Denmark, *in the British Museum*, of copper; this form is rarely found in copper, with section.—Fig. 38, from Denmark, of bronze, from *Madsen's Afbildninger*, *&c.*, *Hefte* iii.—Fig. 39, ditto with semi-circular blade, *Madsen*, *Hefte* iii.—Fig. 40, from Hessen, and now in the collection at Hanover, *Lindenschmit*, *Hefte* i, *Taf.* iii.—Fig. 41, from near Baltringen, *Lindenschmit*.—Fig. 42, from Neinheilingen, in Thuringia, *British Museum*, with section.—Fig. 43, from the Terramara Beds, Castione, Switzerland; with section, *Keller*, *Plate* lix.—Fig. 44, from Unter Uhldingen; with section, *Keller*, *Plate* xxix.—Fig. 45, from the Terramara Beds, Castione; with section, *Keller*, *Plate* lix.—Fig. 46, from the Terramara Beds, Castione; with section, *Keller*, *Plate* lix.—Fig. 47, from Hallstatt, in Austria, *Das Grabfeld von Hallstatt in Oberösterreich und dessen Alterthümer von Dr. E. F. von Sacken*, *Taf.* vii; with side view.—Fig. 48, ditto, *ditto*, found with the body of a child.—Fig. 49, ditto, the shaft of bronze, and the blade of iron, from Hallstatt.—Fig. 50, the same form in iron, also from Hallstatt, *in Mr. John Evan's collection*.—Figs. 51 and 52, similar forms, in bronze, from Italy, *in the British*

* I have been enabled to take drawings of these celts in the British Museum, through the kind permission of Mr. A. W. Franks.

† The forms included in classes D, E, F, and G, are commonly known under the name of *paalstab* or *palstave*, a word of Scandinavian origin, said to have designated the weapons employed by some northern tribes for battering the shields of their enemies. Iron implements like the Irish *loy*, and called *paalstabs*, are still used in Iceland, either for digging in the ground or breaking the ice.—*Catalogue of the Museum of the R. I. Academy*, *Bronze*, p. 361.

‡ Horæ Ferales.

Museum.—Fig. 53, the same form, from Telsch, Vilna, Russia, *in the British Museum;* with two sections.

Class E.—Bronze celts having both the cross stop and the longitudinal flanges. In the earliest form, the cross stop and flanges are raised upon the faces of the blade, as in class D. In the more improved form, the upper part of the shaft of the blade is hollowed so as to answer the same purpose and economise the metal. Fig. 54, from Ireland, with rudimentary stop and flanges, *in my collection.* Fig. 55 and 56, ditto *ditto*, with rudimentary stop, the flanges more developed, *in my collection.* Fig. 57 showing a development of both stop and flange, ditto, *ditto.* Fig. 58 showing the stop and flange further developed, and the metal of the upper part of the blade slightly sunk, ditto, *ditto.* Fig. 59, a further development of the same, the metal of the upper part of the shaft of the blade reduced to a minimum.—Fig. 60, the same form as Fig. 54, from Denmark, *Madsen, Hefte* iii.—Fig. 61, from near Mainz, *Lindenschmit, Taf.* iii,—Fig. 62, from the Museum at Wiesbaden, *Lindenschmit, Taf.* iii.—Fig. 63, from Altona, in Courland; this form has some affinity to Class G, but is introduced here on account of the expansion of the blade.—Figs. 64, 65, and 66, from Italy, *in the British Museum,* the metal of the shaft slightly sunk to produce a stop.—Fig. 67, from Fiesole, Italy, the metal part of the shaft further reduced.—Fig. 68, from Baron von Stackelberg's collection, *in the British Museum,* also described in *Klemm, Werkzeuge und Waffen, p.* 103, *fig.* 180, said to be from Greece, but its close resemblance to those from Italy is remarkable.

Class F.—The same form as Class E, but having the flanges bent by hammering over the stop; the flanges appear to have been cast upright, as in Class E, and to have been bent over the cleft handle after hafting; by this means the necessity for binding the blade on with thongs was obviated. This class forms a transition to the socket type.—Fig. 69, 70, 71, from Ireland, *in my collection.*—Fig. 72, from the Royal Irish Academy collection, having a loop on the side. *See Catalogue, R. I. A., Bronze, page* 379. The introduction of the loop appears to be synchronous with the abandonment of the binding, the overlapping flanges answering that purpose by enclosing the bent portion of the handle, and requiring only that it should be fastened by the loop to prevent its falling off the end of the handle.—Fig. 73, from Denmark, *in my collection.*—Figs. 74, 75, from Denmark, *Madsen, Hefte* iii.—Fig. 76, from the Museum at Hanover, *Lindenschmit.*—Fig. 77, from the Museum at Munich, *Lindenschmit, Taf.* iv.—Fig. 78, from Möringen, Switzerland, *Keller, Pl.* xli.—Fig. 79, from Nidau-Steinberg, Switzerland, *Keller, Pl.* xxxv.—Fig. 80, from Hallstatt, *Von Sacken.*—Fig. 81, from Italy, *British Museum.*

Class G.—The pocket type: the bent portion of the handle in this case was retained in its place by pockets cast on each side of the shaft of the blade; it seems doubtful whether this or Class F is to be regarded as the nearest approach to the socket type. In Class F the overlapping was produced by hammering the metal; but Class G is a further advance in the casting process.—Figs. 82 and 83, from Ireland, *in my collection;* the latter with loop, the pockets or pouches to receive

the points of the bent handle are shown in the sections.—Fig. 84, from France. See *Matériaux pour l'Histoire de l'Homme.*—Fig. 85, found 12 leagues south of Oviedo, Spain, *in the collection of the Society of Antiquaries.*—Fig. 86, from Andalusia, Spain, *British Museum.*—Fig. 87, from Denmark, *Madsen, Hefte* iii.—Fig. 88, from the collection at Munich, *Lindenschmit.*—Fig. 89, from the collection at Hanover, *Lindenschmit.*—Fig. 89a, an iron celt of the same form, still in use by the Kalmucs, Siberia, *Prehistoric Times, p.* 26.

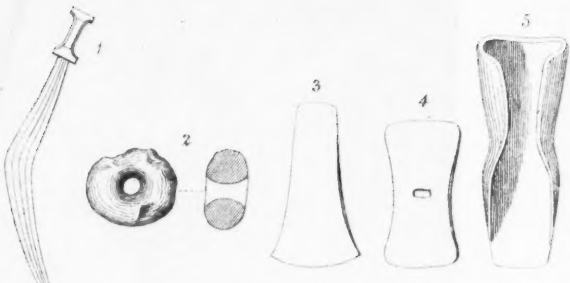
Class H.—The socket type. In some of the specimens of Class G, as for example, Figs. 82 and 83, the metal portion of the shaft of the blade dividing the two pouches is reduced to a minimum. The next step was to do away with it altogether and enlarge the sides of the pouches so as to form a single socket. By this means the bent handle no longer required to be cleft to receive the blade, but was inserted whole into the socket, producing greater firmness, each blow of the axe serving to fix it more securely to its handle. The loops, seen only occasionally on classes F and G, are almost invariably present in Class H.—Figs. 90, 91, 92, 93, 94. Socket celts of bronze, from Ireland and England, *in my collection;* the form with square sides is very uncommon in Ireland.—In Fig. 92 a representation of the overlapping flange of Class F is cast on the surface of the socket.—Fig. 94a, a socket celt of wrought iron with loop, from Merionethshire, *British Museum; Archæologia Cambrensis, vol.* i, *third series, p.* 250.—Figs. 95 and 96, the same forms from France. See *Matériaux, &c.* The square sided celt is common in the north of France.—Fig. 97, from Alemquez, Portugal. *Col. Société des Achit. Portugais.*—Fig. 98, from Denmark, *in my collection.*—Figs. 99, 100, Denmark, *Madsen, Hefte* i.—Fig. 100a., an iron socket celt, from the moss of Nydam, in Slesvik, of the iron period, and believed, from the Roman coins found with it, to be of the third century,* *Denmark in the early Iron Age, by Conrad Engelhardt, Pl.* xv.—Fig. 101, from the collection at Hanover, *Lindenschmit.*—Fig. 102, from the Museum at Mainz, *Lindenschmit.*—Fig. 103, socket celt of iron, from Golssen, *Klemm, Fig.* 195.—Fig. 104, socket celt of iron, from Thuringia, *Klemm, Fig.* 194.—Fig. 105, of bronze, from Unter Uhldingen, Switzerland, *Keller, Pl.* xxix.—Fig. 106, of iron, found near Marin, Switzerland, the socket formed by beating over the blade on one side only; the socket is not quite completed. See *Keller, Pl.* lxxi.—Fig. 107, the same form of iron, found near Marin; the socket is closed and completed all round, *Keller, Pl.* lxxi. These specimens in iron may be regarded as connecting links between classes F and H. Viewing the occurrence of iron celts of this form, it appears not impossible that the introduction of the socket type, and the sudden abolition of the central division, may have been suggested by the use of the more malleable metal, by means of which the fabricator acquired the art of forming a socket by bending over the metal on one side; the inutility of the central division would thus become apparent.—Fig. 108, bronze socket celt with loop, from Hallstatt, *Von Sacken.*—Fig. 109,

* *Prehistoric Times,* p. 9.

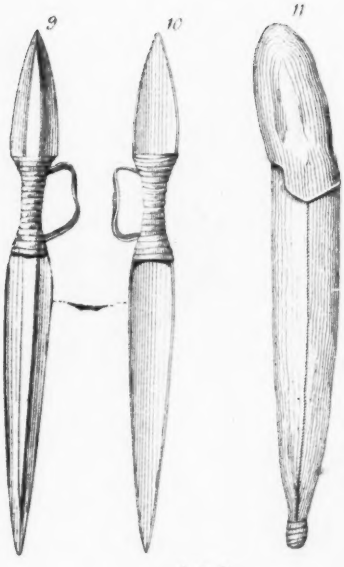
exactly the same form in iron, from Hallstatt. A portion of the wooden handle is still shown in this specimen.—Figs. 110 and 111, bronze socket celts, from Italy, of a variety peculiar to that country, *British Museum.*—Fig. 112, socket celt of copper, from Hungary, believed by the author to be the only known specimen of pure copper. *Keller, Pl.* lxxviii.—Fig. 113, bronze socket celt, from Hungary, *British Museum.*—Fig. 114, bronze socket celt, with two loops, from Kertch, *British Museum.*—Fig. 115, bronze socket celt, from the province of Viatka, Russia. See *Matériaux, &c.*—Fig. 116, bronze socket celt with two loops, from the Oural, Russia.—Fig. 117, mode of hafting, Classes A, B, and C.—Fig. 118, mode of hafting, Classes D, E, F, and G.—Fig. 119, mode of hafting, Class H.

In a paper lately read to the Society of Antiquaries by Dr. Thurnam, he has drawn attention to the fact that none but celts of the most primitive type, viz., those belonging to classes B, C, D, and the most rudimentary form of class E, have been found in the British tumuli. Scarcely a single instance of the more developed palstave or of the socketed celt has as yet been discovered, the only exceptions being a bronze socket celt, found in a tumulus on Plumpton Plain, near Lewes, and a diminutive bronze socket celt found in a tumulus at Arras in the Yorkshire wolds; these Arras barrows are known, however, to belong to the iron age, having produced, amongst other articles composed of that metal, the iron tire of the wheel, and trappings of a war chariot. We learn from this that the discoveries in the tumuli confirm in point of time the order of development inferred from a consideration of the implements themselves.

From the foregoing detailed description of Plate XXXII, we are enabled to draw the following conclusions, viz.:—1stly. That in each of the divisions of Europe therein represented, traces of the development of the celt, from its simplest to its most complex form, have been discovered, the earliest forms being in imitation of those of stone, and being not unfrequently constructed of pure copper. Where some of the connecting links are wanting in the table there is reason to suppose the absence of those links may be the result of imperfect information, and does not necessarily imply a flaw in the continuity of development. 2ndly. That, notwithstanding the simultaneous development which appears to have taken place in different countries, we may nevertheless observe slight differences in the details of construction, which are sufficient to give a distinctive character to the celts of each separate region. Thus, for instance, the celts from Ireland are, as a general rule, shorter and less elegant in form than those found on the Continent. Class C, consisting of stop celts without wings, though common in Great Britain and Ireland, is, so far as I have been able to ascertain, unknown on the Continent. On the other hand, Class D, having wings without stops, is rare in Ireland, but common in France, Denmark, Germany, and Switzerland. The development of this class of celt into a nearly circular edge, as represented in Figs. 34 and 35, is peculiar to the south of France, though traces of it are observable in the celts from Germany, Fig. 40. Class E, having both stop and flange, is found in a more rudimentary stage in Ireland than elsewhere. The



COPPER IMPLEMENTS.
NORTH AMERICA.
Scale 1/7



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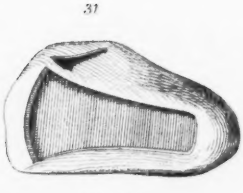
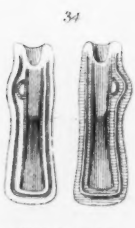
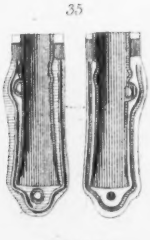
CELT



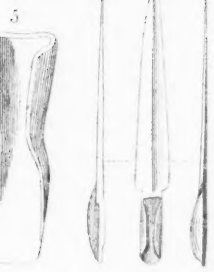
IRELAND



SWITZERLAND



NORMANDY



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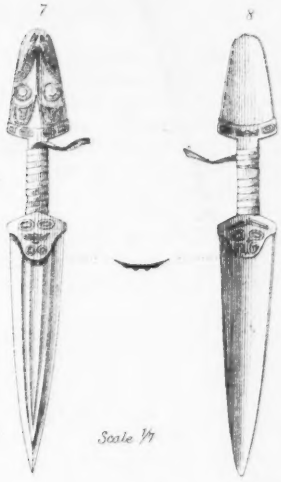
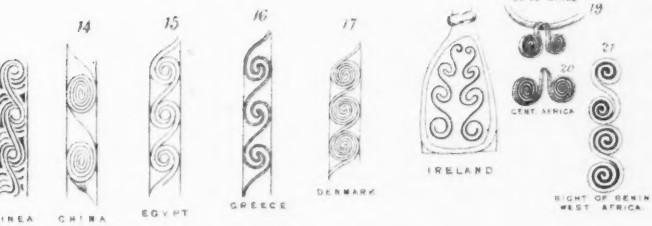
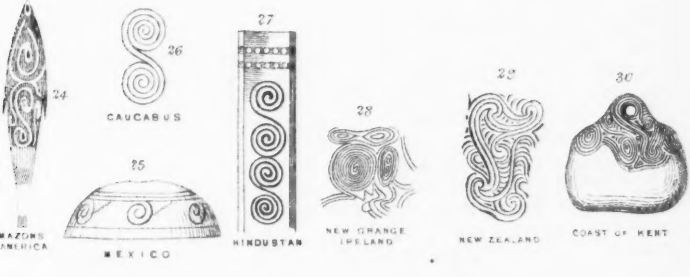
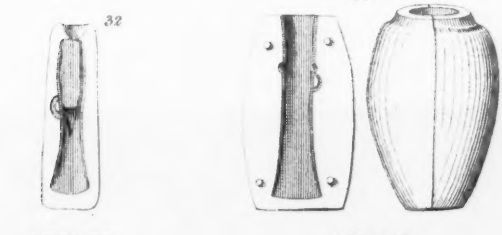


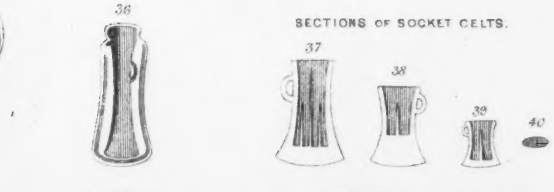




T MOULDS

Scale 1/7





palstaves of this form, having shoulders on the side of the blade, are peculiar to Italy and Switzerland, Figs. 66, 67, and 68. Class F, with overlapping wings, is but slightly developed in Ireland, but is fully so in Italy, Germany, and at Hallstatt. Class G, the double pocket variety, has its head-quarters in the north-west of France, but is also known in Ireland, Denmark, Spain, and Germany; it is, in so far as I have been able to ascertain, unknown in Italy. Class H, the socket type, varies greatly in different countries, the square form, Figs. 93, 94, 95, 96, 100, and 102, is exceedingly rare in Ireland, but common in France. The socket celts from Italy, Figs. 110 and 111, are of peculiar type, and evidently derive their form from the winged palstave of the same country, Fig. 67. Socket celts of iron have been found at Hallstatt, in Switzerland, Denmark, Germany, and North Wales. The representation of the overlapping wings, cast on the surface of the socket celt, Figs. 92 and 101, is common in England and Germany, but exceedingly rare in Ireland. The double-looped socket celt, Figs. 97, 114, and 116, appears to be especially characteristic of the Eastern provinces of Russia and Siberia, though found occasionally elsewhere.

In attempting to account for the varieties which I have described in the details of construction, coupled with a general uniformity of design throughout the entire region of distribution of these weapons, we may, I think, draw an exact parallel between the development of bronze celts and the development of the forms of cannon between the fourteenth and the nineteenth centuries. From Europe to China we know that the form of cannon has developed upon the same plan. In the same way that the overlapping wings of the palstave were represented on the faces of the socket celt, so the rings of metal which bound together the bars of which the ancient bombard was composed, were represented on the surface of the cast bronze cannon which superseded it. In every country the general type of development of cannon has been the same, but the details of construction have varied in each. Even in our own time the introduction of breech-loaders has been synchronous throughout Europe; but the French and English cannon are not perfectly identical. Now, the cause of this is sufficiently well known. There has been constant intercommunication between the several countries throughout the whole period of the development of this weapon. Each new improvement as it occurred has been communicated from one country to another, either by contact in war, or by peaceful intercourse, but each country has fabricated its own weapons, and has by that means contrived to give them a national character.

So in like manner we must assume that the development of the bronze celt extended over a long period of time; that each new improvement was communicated from tribe to tribe and from nation to nation; but that each country manufactured its own implements, and varied in the construction of them. The proof that this was the case is found in the circumstance of moulds for casting them having been found in different countries. Fig. 31, plate xxxiii, represents a stone mould, found at Ballynahinch, co. Down, Ireland, and figured in

the Catalogue of the Royal Irish Academy; it is adapted for casting celts of the Class B. Fig. 32, a stone mould for Class G, found at Montaigu, near Valoignes, Normandy, and is taken from a cast in the Museum of the Society of Antiquaries. Fig. 33, a stone mould for Class H, from Kilkenny, Ireland. Fig. 34, two halves of a bronze mould for Class E, from Morges, Switzerland, figured in Keller, *Plate* xxxix. Fig. 35, two halves of a bronze mould for Class H, found in the Forest of Bricquebec, Normandy, in the Museum of the Society of Antiquaries. Fig. 36, one-half of a bronze mould for Class H, from England, figured in the Catalogue of the Royal Irish Academy, bronze, page 393. In the three last specimens it will be seen that the mode of fitting the two halves together, so as to prevent the escape of the metal, is by means of a ridge on one-half, fitting into a groove in the other. It is improbable that a contrivance so identical as this should have arisen independently in the three countries. Further proof of connection is shown by the identity of the ribs in the interior of the sockets of celts belonging to Class H. Figs. 37 and 38 represent sections of socket celts from Ireland, the former showing three, the latter one, longitudinal rib of raised metal running from the bottom of the socket for some distance up the side of the interior of the socket. Fig. 39, is the section of a socket celt from Denmark, in my collection, having one rib of the same kind. It has been suggested that these ribs represent the interstices between slices of the core, by means of which the socket was formed in casting; if so, the cores must have been constructed of some hard material, cut in slices, in order to facilitate their removal from the socket when formed. Several objections may, however, be urged against this; in the first place, no such cores have ever been discovered, which tends to the supposition that the cores must, in all probability, have been constructed of clay; in the second place, it will be seen by reference to Fig. 20 that this celt has only one central rib; if, therefore, the rib was formed by the metal pressing into the interstices between the slices of the core, it is evident that the core in this case had only two slices; but it will be seen that the aperture of the socket expands towards the bottom, and it would have been impossible, therefore, to extract the core if it were divided into only two parts.

The theory of core slices must, therefore, be abandoned, and we are driven to the conclusion that the ribs must have been intentional, either to give strength to the celt, which is unlikely from the great thickness of the metal, or to form channels for the passage of the metal in casting, or, what is more probable, to serve the purpose of gripping the portion of the wooden handle which fitted into the socket, and preventing its shifting with the blows of the weapon. Fig. 39 represents cross ribs at the bottom of the socket of a celt from Denmark, in my collection. Whatever may have been the purpose for which the ribs were formed, their identity in the implements of the two countries serves us as an additional proof of intercourse between them.

Although moulds for casting celts have not been found in Denmark, there is evidence to show, from vestiges of scoriæ that have been found,

that they were there cast in clay, as indeed they must probably have been to a great extent in other parts of Europe.

It would be premature to speculate upon the primary sources of the bronze civilization of Europe, until we have examined carefully the distribution of the other weapons belonging to that period. This much may, however, I think, be said with respect to the geographical region of bronze celts, that they belong more especially to the north and west of Europe; they have never been found in any of those countries which were occupied by the Phœnicians, nor have we any sufficient reason for believing that they were common in Greece. We have, therefore, no evidence whatever for supposing that the north of Europe derived the first idea of these weapons from either of those nations. We certainly have only negative evidence as yet for affirming that they did not, but the burden of proof must rest with those who have attributed them to the Phœnicians. To what extent they were employed in Russia and Northern Siberia, is a point which we have not as yet sufficient evidence to determine. I think, however, I am justified in saying that those hitherto discovered in Siberia are of a late type, belonging chiefly to the socket variety, and that they are there often associated with weapons of iron. I trust, however, to have an opportunity of entering more fully into this subject on a future occasion, when treating of the weapons of the later bronze, and early iron periods of Europe.

ON MITRAILLEURS, AND THEIR PLACE IN THE WARS OF THE FUTURE.

By Major G. V. Fosbery, V.C., H.M. Bengal Staff Corps.

It has been so often, and so convincingly stated, that the loss of life in each fresh contest stands rather in an inverse than a direct ratio to the perfection of the arms made use of, and so evident a good to all engaged results from any limitation of the duration of war itself, that I shall not commence this paper by any apology for such attention as I have paid to a class of weapons which are called infernal or inhuman, only by superficial reasoners, or by those who fail to comprehend the lessons conveyed by military statistics.

The arguments which condemn a warlike instrument simply on the grounds of its destructiveness to life, provided that it neither adds new agony to wounds, nor new terrors to death itself, are, if logically pursued, simply retrogressive, and even if not recommending by implication a return to the bow and arrow, at all events point to the old times of protracted wars, and deaths from fatigue and disease, far exceeding in number those caused by the weapons of an enemy. We can, therefore, afford to set them on one side, or rather, we are bound to neglect them altogether, and seriously consider any invention

which, under the conditions above laid down, promises us a more certainly destructive fire than that attainable, *cæteris paribus*, by the arms at present included in our war materiel.

I hope to show as I continue, good reason for believing that the Mitrailleurs belong to this class, and to prove that they must, therefore, possess for us an interest which justifies me in calling attention to the whole question, as one likely sooner or later to become of grave importance.

I will, therefore, commence by giving a short definition of the arms which I propose to consider, with a sketch of their rise and progress, describing such of them as have come under my personal observation.

From this I will proceed to detail the effects which may reasonably be expected from them, comparing these effects with those of the weapons of our present field equipment, and conclude by a summary of the considerations which would seem to assign them a definite place in the armaments of the future, both naval and military. Should I fail in convincing all of the necessity, which some already proclaim to exist, for the adoption of such an addition to materiel already extensive and complicated, I shall in any case have fairly laid before my readers the main points of a question which at the present moment largely occupies the attention of those among military men, both at home and abroad, whose ideas are neither retrogressive nor stationary.

First then as to the definition of the mitrailleur; and here I think it scarcely out of place to complain a little of the poverty of our military technology, which contains no equivalent for this term, one coined I will admit, but coined immediately on the production of the weapon itself, and admirably expressive of its effects. With us the *mitrailleur* remains either an adopted word; is rendered "machine gun," which hardly conveys the idea; or again, Americanized into "*battery*," as in the case of the "*Requa*" or "*Gatling*," gives us still less the notion of a single instrument.

Colonel H. H. Maxwell, of the Royal Artillery, in the preface to his admirable translation of Colonel Marey's memoir on swords, makes, I remember, a similar complaint when he finds himself compelled to express the term "*Armes blanches*" by fifteen English words in order to give its full signification to the title of his author. Till, however, the wit of some genius finds us a true English equivalent, mitrailleurs, mitrailleuses, machine guns, or batteries, they must remain, and as such I shall proceed to describe them. Mitrailleur, the term I have adopted in the title of this paper, perhaps best of all expresses what is intended, namely, a weapon producing a hail storm of comparatively small projectiles; and to avoid confusion, I shall apply it to these inventions indiscriminately, whether or no in my opinion all are equally deserving of the title.

From very early times the idea of uniting in a single mass, or upon a rigid framework, a considerable number of barrels of small calibre, to be fired simultaneously or in rapid succession, has been frequently entertained, and now and again carried out with considerable ingenuity.

Colonel Martin, late of the 4th King's Own, in 1860 invented and

brought forward a "war truck" and "rifle battery," fitted with a number of independent barrels, the former of which would take an intermediate place in the scale of such inventions somewhere between Fieschi and the Requa battery, which indeed is probably little more than an adaptation of his principle. Again, in 1862, General O. Vandenburgh, of the American Army, lectured in this Institution on "A New System of Artillery, for projecting a group or cluster of shot."* His gun, the details of which were very carefully worked out, and regarding the history of which I have lately learned several curious particulars, resembled in general principles the mitrailleur Favchamps, and though inferior to that weapon in the use of loose powder, and in the method of ignition, still bears a strong family resemblance to both the Montigny and French mitrailleurs. General Vandenburgh was, however, in advance of his time, the metallic cartridge was as yet unknown, and though he proved himself thoroughly to understand the considerations which give to such instruments their special value, his system in its original condition would prove but of little service as a weapon of war.

Other and older arms of this nature are to be found in the Rotunda at Woolwich, in the Tower, in the museum of this Institution, and in other collections of curious inventions. The machine of Fieschi was perhaps the first of them which produced any notable effect, and still forms the type on which several later weapons have been modelled. I think, however, notwithstanding the claims of Favchamps and others to originality of invention, and even some partial successes in practical experiment, the mitrailleur as a weapon of war was impossible until the metallic cartridge had been brought to its present perfection, and that we need concern ourselves neither with claims nor weapons anterior to that date, which indeed is a very recent one.

I am aware that a great number of inventors would disagree with me, when I state my opinion, that I am disposed to consider many an invention as I would a mass of metal, objectively it may be, because potentially valuable, but subjectively as useful to us, as was the wedge of gold to Crusoe in the solitudes of Juan Fernandez, and I would therefore award fully as much credit to him who forms it into a sword or a ploughshare, that is who makes it practically available for the ordinary necessities of life, as to him who dug it out of the original hill, or reduced it by fire from its primeval combinations.

Many inventions have remained useless and impracticable until supplemented by a fresh discovery, or by some trifling improvement, the combination being, however, always the work of some head clear enough to understand the full value of the first idea, and more than that, what was needed to bring it to a successful and practical issue.

The latter are the men who, fully as much as the former, deserve our gratitude, and should any be disposed to attribute the invention of the Requa battery to Fieschi, the Agar and the Gatling to the originators of revolvers, the Claxton to Herr Dreyse, or the French and Montigny guns to M. le Capitaine Favchamps, all that can be said is

* See Journal, vol. vi, p. 377.

that in older hands these inventions were clearly unfit for the purposes of war under our present conditions, and that it has been reserved for those whose names they now bear, to render them so in greater or less degree according to the effects which they are capable of producing, and the complication or simplicity of the elements required to produce these effects.

The guns which I propose to consider in the present paper are the Agar, the Claxton, French, Gatling, and Montigny, giving to each a notice sufficient to render its general principles fairly comprehensible, and briefly examining such peculiarities as seem to make each more or less fit for purposes of war.

I have arranged them, as will be seen, alphabetically, and we will therefore commence with the Agar. This gun, of American invention, should be classed with the Claxton and Gatling, as it involves the principle of feeding up to a barrel, or limited number of barrels, and discharging through it or them a considerable number of rounds with great rapidity, as distinguished from the Favchamps, French, and Montigny plan of employing a considerable number of barrels, through which a greater number of rounds is perhaps discharged, but with less fouling, heating, or wear and tear, to any individual barrel. The Agar then consists of a single rifled barrel, of a calibre something between ·568 and ·577, *i.e.*, about the bore of the Enfield. This barrel is firmly screwed into a massive breech piece, and is capable of being quickly replaced by one of two or three spare barrels carried with the machine.

The barrel and its accompanying machinery are mounted on a carriage similar to that which carries a mountain gun or light field piece.

The axle at its extremities carries boxes of ammunition, and on the centre the gun itself, placed on a ball and socket joint, strongly constructed, and giving it horizontal and vertical training through very large arcs.

The ammunition consisted originally of a large number of steel chambers charged with powder and ball, and carrying a cap on a nipple screwed into the rear end. These were placed in a rectangular box, and allowed to roll one by one down an incline which conducted them to a recess formed in rear of the barrel of the gun. A handle connected with a system of cogged wheels being turned, the charged chamber escaped from its provisional position and fell into a carrier, where it formed a prolongation to the barrel itself, a wedge rising behind it secured it firmly for an instant in this position, and whilst it was so held, a hammer falling exploded the cap, and that chamber was done with.

As the handle continued to revolve, the wedge relaxed its pressure, a lever threw the discharged chamber into a shoot leading to another receptacle, and a fresh chamber instantly took its place, the operation being repeated from 100 to 120 times per minute.

In theory nothing could be prettier, and I have myself seen it performed with capped but unloaded chambers with the most beautiful precision.

When the metallic cartridge was invented, it was easy to substitute

for closed chambers small cylinders of steel, each of which contained a Boxer cartridge, which was fired by precisely the same mechanism.

The only thing forgotten seemed to be that when using loaded chambers, and firing at the rate of 100 discharges per minute, the flame of 7,500 grains of exploded powder, and nearly 7lbs. of lead, would pass through this single barrel in that time. The effect on trial proved to be that the barrel grew first red and then nearly white hot, large drops of fused metal poured from the muzzle, and the firing had to be discontinued from fear of worse consequences.

The inventors subsequently adapted to it an ingenious apparatus by which the superabundant heat was rapidly carried off by a stream of air driven through the barrel and through a casing which surrounded it, but I have no reason to believe that such a contrivance could fully answer their expectations—a faulty principle cannot be made good by ingenious devices; nor even that did it do so, the machine as a whole could be applied on any considerable scale to war purposes. One or more of them were, I believe, used with some show of success during the American war for the defence of bridges or narrow passages, and a mantlet carried on the carriage very effectively protected the gun against all small arm projectiles.

This variety of mitrailleur may nevertheless, I think, be fairly considered as disposed of, as not coming up to what is required either in simplicity or power, whilst its supply of ammunition, were there no other reason against it, would be obviously difficult to keep up for any continuous service.

The next in order is the mitrailleur Claxton, also the invention of an American. On this weapon I was lately requested to report for the information of Her Majesty's Government, and having carefully examined the arm itself, its ammunition, and accessories, I am unable to speak of it much more highly than of the Agar. It consists of a revolving framework carrying six or eight rifled barrels, any pair of which may be readily adjusted in front of two sliding breech actions, thus forming for the time being two breech-loading rifles placed side by side. A species of pump-handle placed between them is worked by one soldier, whilst another feeds them with cartridges, and the rapidity of the fire is limited by the physical ability of the soldier to work this handle.

The machine is feeble in construction, slow in action, furnished with ill-conceived projectiles, and mounted on a carriage which a week's service would destroy. The firer is protected, however, by an ingenious shield, and seated on the trail in a way which gives him a good position for the service of the weapon. Although in its present state this arm is undeserving of much attention, there are several things about it worth noticing by those who would thoroughly study the whole subject. Its rate of fire is about 80 to 90 shots per minute, and it is made in two sizes, the larger throwing ½lb projectiles, and the smaller the Chassepôt bullet.

Of the French mitrailleur it does not, I think, become me here to say much, for though I have had means of learning in considerable detail its distinguishing features, and am acquainted with its breech-action, barrels, cartridge, and charge, still the secret is so jealously guarded

by our friends and allies, that it would be an ill return for much official kindness and hospitality shown me, to publish that which after all I have unofficially and indeed almost accidentally learned. I can fairly however state, that the weapon is a most formidable one, it is admirably constructed, and equipped for service, and will, I doubt not, produce, if brought into action, effects almost as astonishing as those of the breech-loader, and cause a general impatience to be possessed of the new arm.

The French gun is of the same class as the Favchamps and Montigny, solidly constructed, and capable of enduring hard service.

Their mitrailleur batteries are, I believe, already numerous, and consist of eight guns each; each gun is served by three men chosen from the sous-officiers of the Horse Artillery of the Imperial Guard, and with this complement it should throw about 300 shots per minute for five or six consecutive minutes, to very considerable ranges, and with an admirable trajectory.

The only fault I should feel disposed to find, would be that for its power, the gun is somewhat heavy, and although I fully understand the intention of this weight, I should be inclined from what I have observed during my study of the subject, to think that less metal, even with their charges of powder, would fulfil every requirement, and permit a handier and more manageable weapon to be brought into the field.

To the French in any case clearly belongs the credit of having been the first to appreciate the importance of this subject, and in spite of the many grave difficulties which attended their earlier essays, to conquer them by laborious constructions and experiments, and produce a weapon far in advance of anything possessed at the present moment by any one of the civilized powers.

That it will fulfil their anticipations I have but little doubt, and should it do so, it will to the full justify the outlay and labour expended on its construction, and the cost of the mystery with which it has been their care to surround it.

The Gatling battery, so called, comes next on the list. It belongs, as I have said before, to the same general class as the Agar and the Claxton, and although possessing in some degree the faults which distinguish these, is a far better considered invention, and one worthy of being placed greatly in advance of any other which embraces the same general principles. It consists of ten rifled barrels made with extreme accuracy, and truly and strongly fitted to a framework, which is again surrounded by a metal cylinder.

An opening in this cylinder permits the entrance one by one of the cartridges, which are of drawn metal and solidly constructed, and to this opening is adjusted a curved box containing a certain supply. As each cartridge falls in turn through the opening, it is carried by internal wheelwork to its appropriate barrel, forced into it, fired by a plunger or striker actuated by a spiral spring, and the empty case is withdrawn. The latter falls through a small distance, and eventually passes out of the casing through an aperture constructed on its lower side. The wheelwork which conducts the cartridge to its place, and, in fact, takes

charge of it from the moment of its escape from the upper box until its rejection at the lower side of the gun, is actuated by a handle fitted to a squared key placed at one side of the breech. The rate of fire is regulated by the speed at which it is possible to turn this handle and keep up the cartridge supply.

I have seen a statement made by Mr. Broadwell, the European agent of this invention, to the effect, that certain improvements having been made in the weapon, it is possible, according as the operator possesses greater or less skill, to fire from it 700 or 500 shots per minute —a most astounding result if true. When, however, we reflect, that in order to produce this result either 70 or 50 shots per minute will have to pass through each of the ten barrels, we must, I think, allow that his enthusiasm for the invention has led him into an exaggeration of its performances. Even supposing it possible to fire with it, 700 shots during one minute of time, it must be evident that many minutes would elapse before it would be possible to fire again, owing to the heating and fouling of the barrels which would necessarily take place. For whilst we know that it is possible with well-constructed ammunition to fire slowly from a rifle several hundred shots without cleaning the arm, the conditions are greatly changed when the temperature is so much raised, as would be the case with a rate of discharge such as that above mentioned. On the other hand, one of these improved Gatlings was lately officially tried at Vienna, in a mitrailleur competition held there. The rate of fire was found to average 280 shots per minute, instead of 500 or 700, and almost every minute produced some interruption of the firing, owing to the sticking of a cartridge which failed to reach its proper barrel, or of a case, which became jammed in the mechanism, after leaving it. It must be evident that *contretemps* such as these ought not to be possible in a weapon intended for field service; and admirably designed and constructed as the Gatlings undoubtedly are, I confess to feeling grave doubts as to whether, for war purposes, they will fulfil all necessary conditions. Whilst I have a right to express a private opinion, I have none to prejudge an arm which will, I believe, shortly be tried officially for the second time in this country, and I therefore say no more regarding it. The rate of fire is stated to be 500 to 700 shots per minute, as I have above said. It has been found hitherto not to exceed an average of 280 to 300, but the official trials about to be made will doubtless show whether or no the already attained results may in some way be largely exceeded.

I have pointed out the difficulty which lies in the way of any excessive rapidity to commence with, provided a continuous fire is desired, namely the small number of the barrels, and the heating and fouling which must take place, even should the mechanism work without hitch or hindrance.

This, even when perfectly clean and in the hands of its own representatives on an artillery practice ground, it has not been always found to do. Whether in the hands of soldiers, and on a field of battle it is likely to do better, can hardly be merely a matter of opinion.

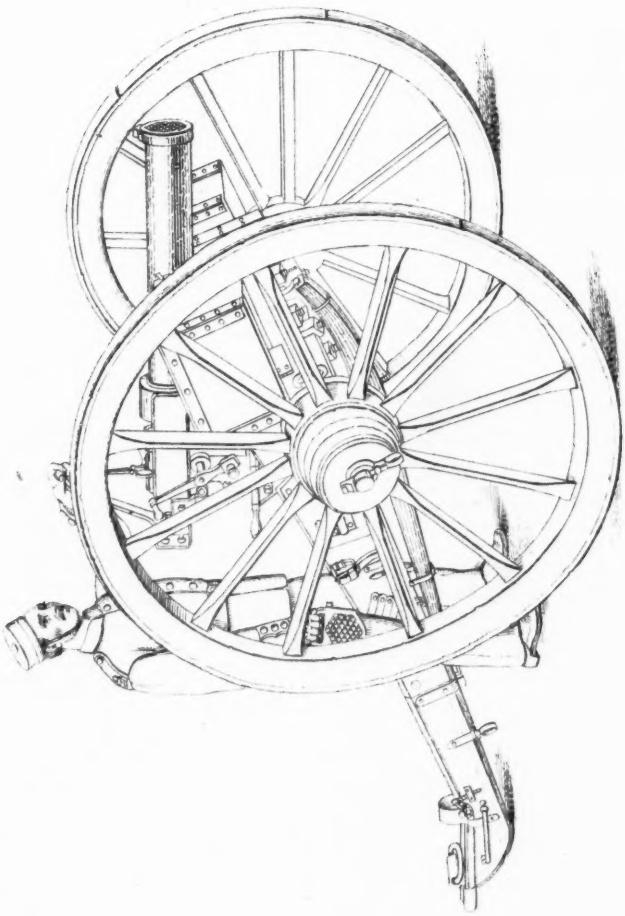
We now come to the mitrailleur Montigny, a representation of which is attached to this paper (Plate xxxiv). My name has, to a certain extent, been connected with this invention owing to my having been lately charged with the superintendence of one of them whilst in process of manufacture for the Government. I must, however, disclaim all share in the invention itself, which is entirely that of MM. Montigny and Christophe of Brussels. At the same time, I consider that in urging on M. Montigny the adoption of Mr. Metford's rifling, and his hardened expanding projectile, instead of the ill contrived, cannelured bullet formerly used with a rifling, but ill adapted to its object; in devising a system by which the cartridges are securely carried on service; and in changing the system of cartridge itself, I have been able to render the invention more suitable for the purposes for which it is intended.

The Select Committee which is about to sit on both this and the Gatling guns will, however, doubtless, shortly decide on their respective merits, and also on the far more important point as to whether or no arms of this nature will be added to our armament of the future. A short description of the gun above represented will close the first part of this paper, and I will then proceed to recapitulate such considerations as appear to me to bear on the mitrailleur question in its broader aspects.

The Montigny mitrailleur, of which a representation is given, consists of an assemblage of barrels contained in a wrought-iron tube, mounted much on the same principle as an ordinary field gun, which, indeed, it somewhat resembles in form. To this a massive breech action is attached, sliding between heavy iron plates. This is controlled by a jointed lever, which is here represented as raised by the man working the gun, and contains a simple contrivance for the separate and successive ignition of the cartridges. The cartridges are carried in steel plates, perforated with holes, corresponding in number and position to the chambers of the barrels, of which, indeed, when in position, these holes form portions, being bored and finished with the same tools and at the same time as the chambers themselves. These plates are about 11 millimetres in thickness, and when the cartridges (which are *central fire*) are dropped into them, they stand out at right angles in the proper position for introduction into the chambers of the gun. Grooves, formed on the face of the breech-block, receive the plate, which being dropped into them now advances or is retired with the breech-block itself.

The gun is here shown in the loading position; a plate of cartridges being now introduced, the gunner would depress the lever which he holds in his left hand, the breech block would advance, pushing each cartridge into its appropriate barrel, and finally become secured in its place beyond chance of accidental disturbance by recoil or otherwise. The contrivance which effects this is a very simple and perfect one. At the same time and by the same motion the whole weapon is set at full cock, ready for firing.

The gunner now quits the loading lever, which requires no further attention, and, grasping the firing handle, shown at the right side of



Mitrailleur Mounted on a Service Carriage

J. Jobbins

the gun, awaits the order to fire. One second of time is sufficient to give a complete revolution of the handle and discharge the whole of the 37 barrels of which the weapon consists, but each may be fired separately and at any intervals of time. When the last barrel has been discharged, he raises the loading lever, thereby opening the breech and withdraws the empty cases by means of the plate which now performs the office of an extractor, or rather of 37 extractors in one. The plate is lifted from its grooves carrying with it the empty cases, and replaced by one filled with loaded cartridges, and the operation is repeated.

To open the gun, remove the empty plate, insert a full one, and re-close ready for firing, takes somewhat less than four seconds. It has thus been found possible to fire this weapon 12 times per minute, throwing therefore 444 rifle shot in that time.

This, I believe, to be the largest number ever yet thrown by a machine of like weight; though, as I have before said, others pretend to the possession of greater powers in this particular.

The Montigny gun has the enormous advantage of simplicity as compared with other systems; and in trials which have lately been made by the Austrian Select Committee and others, it was not found to be deranged by sand and earth thrown over it, or similar imitations of the everyday minor accidents of a campaign. It showed, I believe, in these respects a notable superiority over its rivals, as indeed my knowledge of their principles and construction would have led me to anticipate. The gun as at present constructed consists of 37 barrels of a calibre of ·534 inch, rifled according to the Metford system, which seems to possess a remarkable aptitude for this class of weapon.

The bullet weighs 600 grains, and is hard enough to penetrate without much deformation 29 half-inch dry elm planks at 60 yards from the gun. Its penetration at 100 yards would probably be greater.

The cartridges are by Fusnot, of Cureghem, near Brussels; but it carries the Boxer cartridge admirably. This the Gatling would not do with equal facility. The charge of powder is 115 grains, which might with advantage be increased to 125 or 130 grains; the bullet being made a little heavier at the same time.

The waggon and limber-boxes at present carry 3,034 rounds of cartridge, but might readily be made to carry more.

It has been found by experiment that the 37 bullets thrown by this gun in a discharge occupying one second of time, now cover, at 800 yards, a space about 10 feet in height by about 12 in width, whilst at 1,000 yards the base of the cone of dispersion is vertically somewhat, though little, over 12 feet in diameter.

When I had, in 1868, the honour of preparing for the Secretary of State for India a report on the same weapon in its original state, as to rifling and projectiles, effects such as these could not be produced even at 400 mètres, and yet so formidable were its performances at the ranges then attainable, that it seemed good to Her Majesty's Government almost immediately to order a specimen arm to be prepared for trial.

This weapon was prepared under my personal superintendence, and

has been mounted at the Royal Carriage Factory at Woolwich, with such improvements as were readily attainable with the materials to hand.

I do not, however, hesitate to say that a gun on the same principle might yet be produced greatly excelling the present one in range and efficiency, and capable of still larger practical effects when used against troops upon a field of battle. For this purpose it would be necessary to re-model, not the form nor principle, but the details and proportions; and at a comparatively trifling expense we might thus in a short time be still further in advance of those who have up till now preceded us in their attention to and expenditure upon similar inventions.

I could in far greater detail describe the principles and performances of the mitrailleurs up till now invented or in use, and enter with greater minuteness into their history and progress. I have, however, I think, said enough to enable my readers to judge of them for themselves; they will see without difficulty the distinctions which exist between the two great classes into which they divide themselves, namely, those in which the cartridges are brought into place by machinery more or less complicated, and those in which cavities or chambers containing many cartridges at once are brought into juxta-position with larger numbers of barrels, and fired by comparatively simple means. In the latter class I should personally be disposed to see a greater chance of present success, and the hope of future progress; but in order to attain either the one or the other, the question will need to be most carefully considered to begin with, and it must be the care or the interest of some competent Officer, or body of Officers, to pursue it to a successful issue.

In the present state of warlike invention, no halt can be regarded as a permanent one, and those who look on their armaments, however apparently complete, as being in anything but a state of transition, or at least being unsusceptible of improvement in themselves, or addition to their accessories, will be found most wanting in the day of trial when most is required.

There has been, and with much reason, specially amongst the French and ourselves, a strong feeling in favour of the simplification of field equipment. With them it has governed for many years all the details of their land-service Artillery, which under the immediate eye of the present Emperor has grown into as simple and workmanlike, and at the same time practical and formidable, an armament as exists in the world. With us the feeling has been rather a reactive than a persistent one, and, like all reactions, will tend, if not carefully watched, towards the rejection of much that, had the principle been all along accepted and controlled, would have seemed useful or even necessary. The French, who are notoriously adverse to the introduction of anything, however good, which complicates in the smallest way their field equipment, or tends to render the service of either Artillery or small arms difficult in moments such as those which often decide the issue of great battles, have accepted the mitrailleur, a weapon to which the complications of the Armstrong field gun are as nothing. Nay, more than this, they are said, and I believe with truth, to have expended at least £200,000

on its production, the elaboration of its details, and the well organized secret manufacture, which has given it, in its now complete condition, to their service.

The same considerations which have led them to the adoption of this course should apply with increased force to ourselves, as will, I think, be seen from the arguments which follow, and a patient examination of the whole question. In order to enable us to make this, let us consider, to commence with, what this mitrailleur question really means, and why so much time, ingenuity, and money have been laid out on it. It is hardly credible that if, as some assert, field Artillery fulfils all the requirements of actual service, engineers of known capacity, and Officers of recognized talent, should pay such serious attention and recommend the expenditure of such vast sums, on that which, when produced, would complicate without rendering more effective, the materiel of war.

When, however, we perceive that in its wider aspects the question is one of whether or no machinery can take, in warlike operations, such a place as it has already done in the peaceful arts, and appear in the battle-field to the same advantage as it has done on the road, in the steam-ship, and in the factory, our wonder is diminished, and we see in this, as we see all around us in other matters, activity, because the idea which stimulates it is one of progress, and that, too, in the direction of the economy of labour and preservation of life.

If it be possible by means of a machine, not too liable to derangement, and not too complicated for the comprehension of the soldier, to make three or four men do the work of 120, the advantage must be self-evident.

It is not that we can afford to send home 116, retaining four and giving them a machine, as some would willingly have us believe, and as would be the case in a workshop or factory, but that we are able so to shelter and reserve the 116 that their lives are comparatively safe, and their powers unimpaired, during such time as their enemy refrains from coming to the charge or the bayonet-push, and that they are therefore more competent to repulse an assault, push an advantage, or complete a victory, than they would have been if harassed and decimated by long range fire, to which their strength had been exhausted by replying.

The obvious reply to this argument will be that it is the custom of war to commence every battle by the long range fire of artillery where such is practicable, and that of course common sense will always shelter infantry, if possible, until the very moment when their services are required.

Unless, therefore, some reason can be shown which gives the mitrailleur a decided advantage over artillery, you but advance a plea for a larger employment of that arm. Here, therefore, it will be proper to consider what artillery can and cannot do, and why we should propose an intermediate weapon for employment in the unfilled space which I hold to exist between it and the weapon of the infantry soldier, even under its most advanced conditions. That this space does exist, is believed by many who are far more competent to judge of the whole

question than I am myself; indeed the efforts which have been made, and are making, to fill it, themselves testify to its existence.

It is rare in this very practical day of ours to find continuous, intelligent exertion used to supply a want that is purely imaginary, and rarer still, to find an effort made to create an artificial want by the perfection or abundance of the supply.

Let us therefore endeavour to see how it arises, and what are its limits, and in this way by localizing and defining, so to speak, the fault, we shall be the better able to judge of the remedy proposed, and its fitness for the purpose.

A prolonged trial of field artillery has, as most of my readers are aware, lately taken place on Dartmoor, and we have had an opportunity such as rarely occurs of judging of the effects producible by the weapons now in our hands.

It is a subject for regret that at all ranges within reach of the infantry musket, bodies of foot were not opposed to similar targets, and under similar limitation as to time, &c., as the guns, and comparative as well as positive data obtained, by which the relative values of the fire of the two arms might be ascertained, and hints for their economic employment afforded.

The broad results of such experiments as did take place are, however, now generally known, and the universal feeling seems to be one as much of surprise as disappointment at the meagreness of the effects produced, when compared with the powerful and ingenious apparatus, and the amount of skill and intelligence required to produce them. We now know that a system of defence of the most simple character is amply sufficient to protect infantry, when stationary, from the effects of our field guns; and when in motion that, except under circumstances rare enough now, and which will every day become more so, the most perfect projectile we have, will on an average only drive home 20 effective fragments, each capable of inflicting death or a severe wound into a close column at from 1,000 to 1,500 yards.

In order to produce these 20 fragments and render them efficient, many independent operations must be truly performed, and even then sudden gusts of wind, or considerable barometric variations, may render all of no avail by their influence on the flight of the projectile, by delaying or accelerating the burning of the fuzes. Under the most favourable circumstances, when employing time-fuzes, it is impossible to secure, even within moderate limits, a similar cone of dispersion of shrapnel bullets, or segmental iron, for any two successive shots at the same range.

The gun must be laid between every discharge, an operation demanding time and care, necessitating a clear view of the object, and all but impossible to get exactly repeated by the most highly-trained and skilful gunners when on an artillery practice-ground, and neither greatly pressed for time, nor deprived, in however small a degree, of that *sang froid* which few persons possess completely, when exposed to a lively fire, and endeavouring to crush it by the rapidity of their own.

The field gun can be fired but five times in two minutes with reasonable

precision, and would, therefore, supposing no single shot to be thrown away, or less than to the full effective, produce in that time no more than 100 effective pieces of metal. So great, however, is the difficulty attending the adjustment and service of time-fuzes in rapid and sustained firing, when the ranges are apt to be constantly varied by an enemy's motion, that I have heard it asserted by able artillerists that under these circumstances the time-fuze ought never to be employed. We should then be forced back on the use of the concussion-fuze, which will ignite the bursting charge of the shrapnel or segment-shell only after the latter has come in contact with some body giving sufficient resistance to cause a slight but sudden diminution of the velocity of the projectile.

In action we find always two methods of getting this function performed, the one is to strike the ground at a short distance in advance of the troops intended to receive the benefit of the fragments; the other is to use the body of one of your enemies as the resisting medium. Both have certain disadvantages, though both are capable of producing great effects. So great and so rapid is the deflection of rifled projectiles after striking the earth, that it will frequently occur on any but the most favourable ground that the whole projectile will have taken up its new direction, whether vertical or horizontal, before the explosion has formed the fragments by which the effect is sought to be produced. Or again, the graze takes place too soon by a distance almost impossible to appreciate at the gun itself, or too late by a like distance, and the effect of the shot is equally lost.

Again, supposing the body of a soldier to be selected as the *pièce de résistance* by which the shell is to be exploded, he must, in order to act properly and efficiently, be the front rank man of a column or other deep formation; if the shell passes him by, and strikes no one until comparatively far into the column, its cone of dispersion will be a small one at its exit from the formation, and the effects not very considerable; whilst in firing at troops, either in loose order or in line, such practice would obviously fail to produce serious effects, whether moral or physical.

I have myself witnessed practice in Belgium with shrapnel exploded by graze, and though this was conducted on most favourable ground at large and lofty wooden screens, and at a distance of no more than 400 mètres, it was evident that a large proportion of the fragments would have wholly failed to produce any effect on a line, though considerable damage might doubtless have been done to troops in rear, supporting or in reserve.

In several instances the form of the surface, though consisting of sandy heath, and free from great irregularities of contour, and from surface stone, evidently deflected the projectile before the explosion was sufficiently matured (if such an expression can be admitted to explain an effect which is but a falling short of absolute instaneity), and the fragments were in large numbers carried high over the screens.

Still I will admit that, standing as we did behind a turf screen in front of the targets, and in a position to see the graze and burst of each shell, the practice had a very formidable appearance, and such as

would have severely tried the courage of troops exposed to it. Always supposing it possible for field guns to be unlimbered and worked on an open plain within 400 mètres of a line armed with breech-loaders, the rapid, and on the whole accurate, bursting of the shrapnell, the rush of the liberated bullets, and the tearing and screaming sound of the angular fragments of iron, passing through and over the space supposed to be occupied by a line of living men, whilst it might actually perhaps produce less effect than that to be obtained from time-fuze practice, and still less than that obtainable when the line itself was fired at with concussion-fuze, would be calculated to shake the nerves, and in a measure demoralize an enemy more than either.

It is humiliating to human nature to be so often compelled to admit the large part that mere animal instinct plays in its greatest successes when achieved by large numbers, and how closely many of the heaviest reverses of an army resemble the mishaps of the flocks and herds. The boldness of a single leader, or of a front rank, will induce a herd to take a leap or face a danger, and as long as these go on, nothing short of death itself will prevent the remainder from following. In like manner a mob well led becomes for the moment as formidable as an Army, and its members as indifferent to peril, however much they may have been hitherto unaccustomed to contemplate or averse to face it.

Though we use our utmost efforts to substitute discipline for instinct, or rather subordinate the one to the other; with the most highly trained troops, we often find the latter wholly master them, and they will turn with the foremost files from the fire these are unable to face, or follow them to certain death with a courage derived from a similar instinct. Do what we will they will still rush at seeming impossibilities like a herd of antelopes, or stampede like the wild horses on a Mexican prairie.

There would thus seem to be a distinct reason, if once we abandon the use of the time-fuze for rapid firing in the field, for preferring with all its disadvantages the use of the concussion-fuze ignited by graze, to the practice of firing at the head of a column direct, and trusting to its demoralization by the effects on the followers rather than on the leaders.

In any case the Artillery question is involved for the present in many difficulties which may be overcome sooner or later perhaps, but still a growing conviction exists that the gun is unable, with all its improvements, to do as much against *troops* as for its weight, and the large target its horses, waggons, and detachment offer, it should do, or as up till a comparatively late period all believed it did.

For certain purposes it is most admirably adapted, and it would be impossible to diminish by a single gun our present field equipment without loss of efficiency corresponding to such reduction.

Against anything short of shot or shell, certain kinds of defences to be found in any enclosed country would be amply sufficient, and neither mitrailleur nor infantry fire would dislodge the defenders of a garden wall, or render untenable an entrenched post of the weakest construction. Either one or the other would, however, probably far exceed it in effect on troops deployed in the open, or for the defence of a defile,

a hollow road, a bridge, or a causeway. As I have before said, it is a matter for serious regret that data for some really practical comparative estimate of the values of Artillery and Infantry fire on exposed targets have not been made, and that we are thus to a certain extent in the dark as to what a given number of guns might be expected to do when opposed to a given number of troops, or supposing either arm to be employed, as may occasionally happen without assistance from the fire of the other, in what proportions they should be employed to effect by their fire a certain object, *i.e.*, a requisite amount of destruction at definite ranges. In the ever-varying conditions of our armament, the data obtained by the practice of ten years since, are of no avail to us to-day; tactics are changed it is true to suit the changed conditions of range and accuracy given by the advance in the rapidity of fire and increased perfection of our weapons, but it must never be forgotten that whilst the introduction of rifling in the Infantry arm increased its range, so as almost to equal that of the unrifled field gun, and its accuracy of fire so as far to exceed it, the introduction of breech-loading to both weapons has multiplied the power of the musket by ten as regards rapidity of fire at short ranges, but has left the field gun where it stood.

Thus the unrifled field-piece could be fired three times per minute with ease, when the necessity for very accurate laying of the gun was not absolute—the muzzle-loading rifle perhaps not quite so much.

The breech-loading field gun has a range far exceeding that of any infantry weapon, but its rapidity of fire, that is, of *effective fire*, is by no means greater than that of the old smooth-bore. Now the rifled infantry musket, whilst losing nothing whatever in accuracy by its conversion to a breech-loader, has gained in rapidity of fire as 10 to 1.

The field gun has got accuracy, I will admit, of the most wonderful character, a range even greater than can be ever required in war except under very improbable circumstances, but has not advanced one iota in the rapidity of its service, and cannot now, in its most perfect condition, throw one shot more per minute than it did in the battles of the Peninsular war. It must follow from this that, whilst the rifling of both arms merely restored the relative conditions which had existed for years, and were first disturbed by the rifling of the infantry musket, the introduction of breech-loading to both has given to the one an advantage almost impossible to estimate without further experience, and adds to the other but an additional complication without any corresponding advantage.

The great advance made by us on the first introduction of the rifled field gun was in the projectile rather than in the weapon, and when we adopted it, the Armstrong segment shell, without doubt, contained the most formidable combination of parts thrown by any gun of equal calibre in Europe.

It is by no means certain even now that it does not for certain purposes maintain a superiority over anything yet devised. For all this we cannot help acknowledging that there will always exist in war situations not calculated to afford either to it or to the improved shrapnel of Colonel Boxer a fair chance of developing their full powers.

The French system of working troops in the field, their loose order in advance, their rapid movements, quick firing, and the advantage they instantly take of the cover afforded either by conformation of the ground or natural shelter of whatever description, would place both at a great disadvantage, whilst their rapid concentration in the final rush on a post or battery would give the guns no opportunity for more than a couple of rounds at best, and these must be thrown in no hurried manner to tell properly and produce their due effects.

The French have adopted this system of tactics in order to avoid the destructive effects of the new guns. They have not done so, let us be sure, without a moral certainty that what has been shown to the world so freely at Chalons as the deliberate choice of the first military nation in Europe, will be copied with greater or less modification by others. We may rely upon it, I think, that no skilful player will allow a hint of his coming play to transpire, unless he is fully prepared for the move his adversary will make in consequence of such information. May we not then fairly infer that their possession of so large a number of mitrailleur batteries has rendered them confident, in case of their tactics being imitated, of being able successfully to deal with troops worked as theirs now are?

It may be said that this is mere hypothesis, and that a hitherto untried machine, or one at least untried on the field of battle, can give no such confidence to its possessors as such a theory as this would imply.

I speak with diffidence as to theory, but with confidence as to the effects of which mitrailleurs, well-designed and well-worked, are capable. For what is the fact? With the field gun in its best condition we produce per round 20 effective fragments or bullets, capable of inflicting serious wounds or death, and we can throw these into a column or other body of troops up to 1,500 yards. We can throw $2\frac{1}{2}$ such rounds per minute under favourable conditions, or 5 rounds in two minutes' of time, that is 100 such effective pieces. When these pieces come to be analysed, we find that some are segments or bullets, some broken pieces of the envelope of iron which fits the gun and carries them up to their destination. We employ for the purpose at the gun itself a certain amount of apparatus for piercing the fuzes, cutting or otherwise adjusting them; or we employ a fuze already prepared, which depends on some careful adjustment of the gun itself for its efficacy. When all is done, about one-half of the weight of metal put into the gun, is finally effective at the object.

But if this is the case, and it would be difficult to prove that more is so, it must be evident that somewhere a great waste of material occurs.

For could a larger portion of metal be made effective, it is clear that it would be useless to carry into the field so large a weight as we now do in order to produce an equal effect; but if a less weight of metal would suffice, then also would a less amount of powder be required to drive it; a gun of smaller calibre might be used, and the whole of our field equipment would become easier to move, handier in the working, requiring fewer men and fewer horses for its transport

and service; and, as a matter of course, both in a military and in an economical point of view, fitter for the service of the country.

So far is this now from being the case, that we find the 9-pounder guns of the horse artillery unable to produce the effects which we should wish to see, and a proposition entertained for exchanging them for 12-pounders, which will doubtless add to the efficiency of their fire, though the additional weight to be dragged must detract to a large extent from their mobility. Supposing for a moment such a change to be carried out, and a horse artillery battery of 12-pounders to be brought into action, not to breach a wall, batter a farm house, nor oppose an enemy's artillery, but merely to play upon troops either awaiting an attack or forming to make one, what do we find? We find guns weighing 900 lbs. each brought rapidly to the front with limbers and waggons weighted with at least twice as much powder, lead, and iron as will ever produce under the best of circumstances, either death or wounds to an enemy; and we find these deaths and wounds dealt out very slowly indeed, at the rate only of about 50 per minute, under these exceptionably favourable conditions.

If a "range-finder" is used, a minute and a-half is consumed in finding the distance of the enemy; if it be not used at any but the shortest distances, the fire is mere guess-work, and may be either good or bad, with a strong presumption in favour of the latter. Superior as our artillery is acknowledged to be, we can scarcely wonder, knowing what we know of its performances, at the failure of either the Austrian or Prussian rifled field services to influence largely the fate of the battles where both were so freely and ably made use of. Neither succeeded in any instance, as far as I am aware, in stopping the advance of infantry or even in greatly impeding the operations of cavalry in the field, though doubtless both were efficient and well served. The crowning victory of all was essentially one of infantry, and was gained in the face of a powerful and protected artillery, although, perhaps, this did not bear with as much power as it might have done on what after-events showed to be the true key of the position, and thus, in face of our horse-artillery fire—good as it is, we might expect troops to stand, and even an advance to be successfully carried out. If, however, it chanced that instead of six 12-pounder guns, with their 50 destructive pieces per gun per minute, the advance took place on a point occupied by a battery of mitrailleurs, would the case be different? I will grant that there would be no bursting of shell, and perhaps, till their power became known and acknowledged, comparatively little of that moral effect which attends a concentrated and sustained fire of artillery; but as regards the destruction occasioned by them—I cannot help feeling certain that it would exceed, up to certain ranges, that producible by any engine of war hitherto made use of which at all approaches them in handiness and portability, or which requires so little previous education for its management.

If the diagram which is appended to this paper be examined (Plate xxxv, fig. 2), the effects of a single discharge of a mitrailleur weighing no more than 400 lbs. at 800 yards will be seen; and at 1,000 yards its performance is almost equally satisfac-

tory. Unfortunately, a miss-fire took place at this range, one of three which occurred during the firing of nearly 2,000 rounds of ball cartridge; there are therefore but 36 shots instead of 37 placed in a parallelogram about 10 feet in height by 12 in width, representing a rifle bullet of 600 grains to about every three superficial feet of surface. A successful shot with a time-fuze shrapnel might do the same thing, or even better for one shot; but it must be remembered, that the base of the cone of dispersion of shrapnel varies as the distance at which the burst takes place from the object, and that with the utmost care it is impossible, even on the practice-ground, to keep this distance absolutely the same for even two successive rounds. But with the mitrailleur the area covered by the discharge merely varies as the distance between the object and the gun itself; no failure of a fuze in its action, no miscalculation of a few yards only in the distance of the object, no fault of cutting, piercing, or adjustment of a good fuze by a well-trained man for a moment flurried in the heat of action, alters its operation in the smallest way, as is the case with the gun. At certain distances it gives groups of projectiles, each of them, be it remembered, of a definite weight and known penetration; and the size of these groups varies merely as the distance itself, but for the same distances is rigidly the same. By a simple mechanical arrangement it is now possible to place these groups, groups such as are seen in the diagram, in such a manner that the edge of one group shall just intersect the edge of that which preceded it, and to treat a whole line if necessary in this manner, giving to each section of 10 or 12 feet its one or two discharges, and proceeding to the next in regular succession. This contrivance is, however, one which will require to be worked either by the firer or by a second soldier standing at the gun. I have, however, proposed to fit to the arm a simple modification of my own invention, which, whilst in no way complicating it, will enable one man to fire the gun, distributing, if he pleases, the fire of a single discharge through a larger horizontal area than that due merely to the natural cone of dispersion, and at the same time commencing the next discharge in a fresh place in an enemy's line. For 12 of these discharges can be, without difficulty, made in one minute of time, and 444 bullets can be distributed over 1,332 superficial feet of an enemy's front at 800 yards with almost as much certainty as we have that the water from a steam fire-engine will, under normal conditions, rise so many feet in the air, or fill a given cubical space in a given time. Further than this, the distance of an enemy being once ascertained, effective discharges can be repeated as often as we please, although we are not again able to relay the mitrailleur through the prevalence of smoke, the darkness, or any other conceivable cause. The gun *must* be relaid between each discharge. The mitrailleur does not require it, but, having once been brought to bear on its object, will continue to pour forth discharge after discharge, covering, according to the range, a definite area with each, and distributing its fire horizontally with mechanical precision. The six 12-pounders would thus, supposing the gunners to be able to catch sight of their enemy between each discharge, and every

Fig. 1.

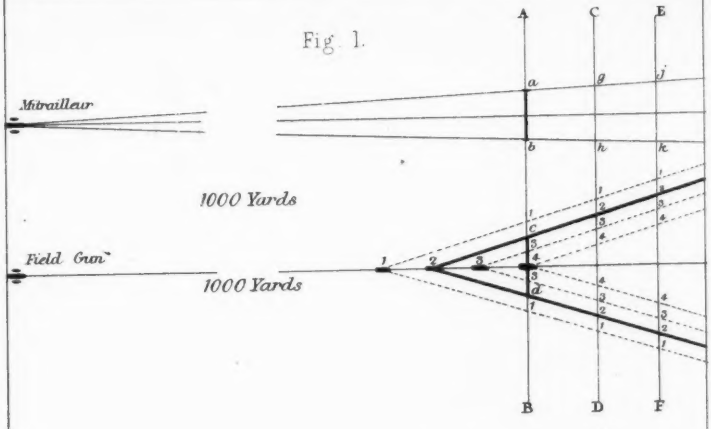
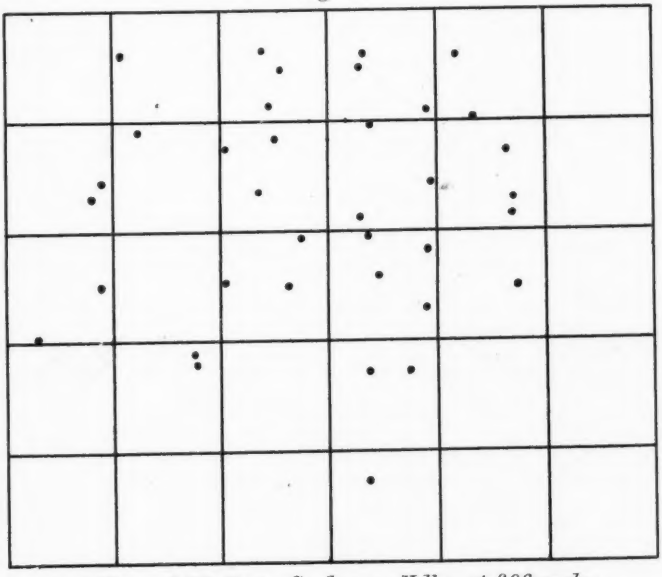


Fig. 2.



1 Plate of 37 Shots, fired as a Volley at 800 yards, at Woolwich, 36 hits, 1 misfire.
Mean absolute deviation 51 inches.
SIZE OF TARGET 18 × 15 FEET.

J. Jobbins.

shot to go well, throw into a body of troops 300 irregular but effective pieces per minute.

The six mitrailleurs having once ascertained their enemy's distance, would mechanically throw into a like body 2,664 rifle bullets of the same weight in the same time; would weigh half as much as the guns, or perhaps rather less, require half the number of men to work them, and one-third the number of horses to draw them, or with the same number of horses would be infinitely more mobile.

It would be difficult to find the troops who could face such a hail-storm as this, thrown even by a single battery. What would be the result of the concentrated fire of several batteries of mitrailleurs on any exposed formation I leave it to your judgment to determine from the data I have placed before you. A most distinguished Officer of artillery, whom I cannot name for obvious reasons without his permission, in discussing with me the mitrailleur question, in which he has taken much interest, asked which I should prefer for the defence of a bridge or other similar position, a mitrailleur, or a 12-pounder field gun, supposing the space to be defended to be some 1,000 feet in length.

I took the side of the mitrailleur, and he that of the gun, "for," said he, "I should fire direct at your instrument and knock it over, and you could do nothing of the sort." It appeared to me, however, that if both gun and mitrailleur were unloaded to commence with, the gun would never be loaded at all; if both were loaded, and the first shot from the gun failed to smash the mitrailleur, the gun could not be loaded a second time, nor would a horse or man belonging to it survive the first minute's practice from the weapon opposed to it. But it is only under exceptional circumstances that the mitrailleur could ever be opposed to the field gun. The latter from its superior range could always retire out of the range of the former, and with its heavy projectiles smash up machine, carriage, and all, at its leisure and with perfect impunity, even should the effective range of the mitrailleur be increased to 1,500 yards, as I believe it will be.

It is only when both are opposed to infantry or cavalry that the one would seem to assert its superiority over the other; that is, the fire of a mitrailleur will, within certain distances, always compare most favourably with the fire of shrapnel, both in the number of pieces taking effect and the regularity of their dispersion.

If there were no other reason for this than that shown in the accompanying diagram (Plate xxxv, fig. 1), I think that proof enough is here afforded of the truth of my statement. For let us suppose two equal spaces indicated by the dark lines *ab*, *cd*, on the general front, AB, of an enemy's line, placed at 1,000 yards from the guns, and that it be desired to render these spaces as dangerous as possible, that is throw into each the greatest possible number of effective projectiles of whatever nature.

Let us further suppose that such space corresponds to the natural cone of dispersion of the bullets thrown by the mitrailleur, which, at this range would be about 12 by 14 feet, *i.e.*, 12 feet in height by 14 in width.

Now it will be apparent that a miscalculation of distance, such as that due to the space between AB and CD or CD and EF, would affect comparatively little the horizontal spread of the projectiles, which will be directly as the distance from the gun itself, or again, that troops in support or reserve on those lines might suffer considerably.

In firing with shrapnel, however, the case is different, for, supposing the projectile exploded at the point 2, to give the requisite degree of dispersion to cover the space *cd*, on the line AB, to the best advantage, it must be evident that on the lines CD and EF, the dispersion will be too large to be efficient.

The same will be the case on the line AB with the premature burst No. 1, whilst 3 fails to cover the space desired, and 4 passes through the line as a single mass.

Nor does the matter rest here, for the dispersion is vertical as well as horizontal. In the case of the mitrailleur it remains a constant quantity for each distance, increasing only as the distance from the gun. In the case of the shrapnel the dispersion varies with the varying distance of the explosion from the object vertically as well as horizontally, and partakes of the same uncertainty in both aspects. As I before pointed out, this uncertainty in time-fuze-practice is a very serious matter, owing to the difficulty of obtaining the range with perfect exactness, and laying the gun and adjusting the fuze with precisely the same accuracy for each succeeding shot.

Nor will this uncertainty be by any means obviated by either of the descriptions of concussion-fuze-firing before described. Furthermore, the high degree of initial velocity which is maintained throughout flight by our rifled projectiles, whilst enormously increasing the effective ranges of shrapnel, adds to instead of decreasing the difficulties of fuze adjustment, by magnifying the effects of any trifling error, however introduced.

On the other hand, the guns, owing to their superior range, can be now withdrawn, when the ground is favourable for the purpose, beyond the ordinary range of infantry fire, or even beyond that of the mitrailleurs. As I once said on another occasion, *had the gun its choice of distance*, a duel between the most powerful mitrailleur and a comparatively light rifled field-piece could only end in favour of the latter.

But in order that the gun should gain this victory, it will be necessary, as it is easy enough to show, to place it in full sight of the weapon it attacks, and some 1,200 or 1,400 yards off, for at less than these distances the gun detachment would be unable to work it with the smallest degree of safety in face of the fire to which they would be exposed.

But it should be remembered that in action it will often happen that both sides are able to choose the ground on which to dispose the various arms for attack or defence, and that an Officer in command of a mitrailleur battery would probably as much dream of placing himself at such a disadvantage, as would a Colonel of cavalry of attempting to charge squares armed with magazine guns or breech-loaders.

Nor must we forget that in war there will always occur situations in which the 1,400 yards range, so admirably suited to the artillery

requirements in a contest of this description, does not exist just where it is wanted, and that guns must either be brought closer in or remain out of action altogether. That, besides this, from its lightness it will always be possible to carry a mitrailleur into positions when no gun equalling it in power at its own range could be brought at all, and from the character of its ammunition, that also possesses peculiar advantages for easy transport.

It is in such situations as these that the mitrailleurs would find their special place, positions requiring a large amount of fire developed perhaps from a small, or comparatively small front, able in the short interval between the appearance of an enemy and his coming to close quarters, to pour in a far larger amount of fire, and with less troublesome conditions, than any other weapon; they could thus deal out to infantry a destruction of which the field gun is incapable *in the same time*, and could prevent any field gun from being placed in position to oppose them.

There are those who appear to forget the rapidly increasing importance that this *time* question will assume in all future contests; in many of the arguments used on one side or the other, in the whole breech-loading and magazine-gun controversy, it has been strangely neglected.

I have frequently been asked, "But pray, sir, what is the use of a gun that can fire 20 shots a minute? In five minutes your men would exhaust the whole of their ammunition, your guns be red hot, and the line engaged without a round of ball cartridge. No one should fire more than 6 or 7 shots in a minute, and a gun is useless, or even mischievous, which enables them to do so." Such questioners seem to me to lose sight of the fact that the power of discharging 20 rounds in one minute, conveyed also that of discharging 5 shots in 15 seconds, and that on those 15 seconds and the 5 shots per man fired in them, would often depend the forcing or the preservation of the key of a position necessary to the safety of an Army, or the repulse of an attack on lines or squares menaced by greatly superior numbers. In like manner the rapidity of fire of a mitrailleur battery must receive its due consideration. It may never be necessary to fire 12 rounds per gun per minute during any action they may be ever engaged in, but in their capacity for such rapid firing resides a power and an advantage which might at any moment prove inestimable.

It is on the final minutes and portions of minutes that the successes or failures of great movements as frequently turn, as on the ability, skill, and forethought employed in preparing for them. A fire of unexampled weight and severity, thrown in at a critical place and moment, will often be more decisive in its results on the fate of the day than whole hours of distant cannonading or long-range ball practice. It was in short intervals of an overwhelming rapid fire that the Prussians found their breech-loaders give them their most decisive advantages. In dealing with an enemy carrying similar weapons, these short intervals of fire, combined with rapid movements and probably with loose formations, are what will have to be looked for and provided against.

Deliberate and continuous movements, in face of either artillery or

infantry, will become more and more impossible, and we shall have to prepare for short and rapid concentrations from extended order, or sudden rushes from cover, natural or artificial, which will give but little time for the use of any slow-firing weapon.

In dealing with such movements, the mitrailleur appears to me peculiarly adapted; loaded in four seconds and fired in one, with no interval for relaying, an automatic distribution of its fire, more effective than shrapnel at 1,000 yards, and as useful as canister at 100; ammunition which a well-instructed infantry soldier can comprehend and make use of with effect;—it would seem to fill satisfactorily the interval between artillery and infantry in a way that is much to be desired.

I should not feel disposed to think that mitrailleurs could be advantageously attached to artillery batteries as were smooth-bored howitzers, owing to the essential difference between the two natures of ammunition, and of the training required for their use, to say nothing of other questions of equipment, rapidity of movement, and difference of range. Nor, on the other hand, should their organization be mixed up in any way with that of foot regiments, as were certain field guns at one time. Infantry should never be hampered in the field by the necessity of keeping to ways practicable for wheeled carriages; they should not have to depend too much on the assistance of any fire but their own, nor should they be capable of being demoralized by the failure, destruction, or capture of any instrument from which they had expected too much.

Again, to look at the economical side of the question, whatever may prove to be the actual original cost of the mitrailleur itself, and this may or may not equal that of the rifled gun, highly trained and highly paid artillerymen are not needed for its service. It will travel with two horses instead of six. Three marksmen taken from the infantry, with a little drill, would be amply sufficient for its management; and furthermore, the cost of its fire per shot thrown is less than one-fourth that of the fire of shrapnel, for if we assume that the price of a 12-pounder shrapnel, with fuze and burster complete, as put into the gun, *exclusive* of the powder-charge, or friction-tube, is 6*s.* 8*d.*, which is probably well within the mark, and that this shrapnel gives 20 effective pieces; then the cost of distributing these pieces on an enemy's front must be 4*d.* per piece, exclusive of its share of the powder-charge and friction-tube, of the pay of the gun detachment, and price and keep of the horses, and carriage generally.

The mitrailleur cartridges can be manufactured with a large margin of profit at £4 per 1,000; the price of each effective bullet, therefore, *inclusive* of charge of powder and detonation, is less than 1*d.*, with, as I have shown before, less than half the number of less highly paid men for its service, and one-third the number of horses for its transport. 37 barrels bound up together no more become a piece of artillery, because they are fastened together and fired by a single man, than they would do had they remained separate and been fired by 37; nor because the machine travels on wheels and is drawn by horses, need it more necessarily be driven and worked by gunners than need a baggage waggon or a fire-engine. On the other hand, although the car-

tridges and individual barrels resemble those used by infantry, for the reasons given above, the two arms should be kept separate.

I have already compared its effects at its own ranges with those of the field-piece, and the following quotation from a thoughtful and well-written article in the *Standard* newspaper expresses as well as I could do the terms on which it is likely to compare with the fire of Infantry. Should these estimates be approximately true, the economy in using, and place in which to use the mitrailleur, will be apparent. After a description of the arm and its mechanism and ammunition, the writer goes on to say:—

"There can be no question on these two points, that such a machine "can be trained with far more accuracy and delicacy than ordinary "rifled small arms from the shoulder; and secondly, that a machine, "unlike a man, has no nerves to be disturbed. With regard to the "comparative values of infantry and mitrailleur fire, we are disposed "to place the latter higher than some who have written on the subject "have done. At extremely close quarters, and with arms of a high "degree of rapidity of fire, it is quite possible that infantry may deliver "a valuable and effective fire of from eight to nine shots per man per "minute. It may be doubted, however, very much, if with any degree "of training possible to be given to ordinary troops, an effective fire "of more than six shots per minute would be obtained at from 350 to "400 yards. The rapidity of fire after this distance will doubtless "bear an inverse ratio largely increasing in its proportion to its effi-"ciency. At 600 yards, four shots per man per minute might be made "to tell, and at 1,000 yards, perhaps not more than three; and this "because we are dealing with the error of the man, added to the mean "deviation of the weapon. The errors of judging distances may be "almost said to increase proportionally as the squares of the distances "themselves. We may, on the other hand, expect the mitrailleur fire "to bear throughout its ranges values approaching far more nearly "those due to the accuracy of the barrels of which it is composed, "and being fired also at a rate constant for all ranges, it is evident that "its proportional value increases enormously with the distance. As-"suming the present Montigny mitrailleur of 37 barrels as a basis of "calculation, the rapidity at ten rounds per minute, and giving to each "barrel the same accuracy as the infantry musket, with, however, a "flatter trajectory and greater range and penetration, we can also "afford to place behind that gun controlling intelligence much above "that required to handle the infantry weapons. We shall probably "find as the result of practice, that whereas at 200 or 300 yards the "effects of the gun will be equal to those produced by the fire of some "fifty infantry soldiers, or at 1,000 yards it will do more actual work "than 200 or 250 muskets. Taking all circumstances into considera-"tion, we are disposed, as matters stand, to place the value of a single "well-built mitrailleur on this construction, properly manned and "furnished, rather above than below, equivalent to 120 infantry. The "French have a more slowly firing arm, heavier, and of fewer barrels; "and these they have formed into batteries of eight pieces each. Such "a battery would equal in value of its fire, supposing these ideas to

"be correct, and the machine guns to be on Montigny's principle, at "least an infantry regiment of full strength, whilst there would be "this advantage, that only twenty-four lives would be exposed to the "enemy's fire instead of nine hundred and sixty. Let us take an "average country over which fighting on ordinary principles could be "conducted, place these eight mitrailleurs in position, with the regi- "ment lying down to cover them, and it must be evident that they "would be unassailable by any force of three times their strength, nor "would it be safe for artillery to approach them, supposing that in "order to do so the nature of the ground compelled them to open fire "within the effective range of the mitrailleurs. Under the present "changeful conditions of the art of war it is difficult to say what "form fortifications will assume, or how long any permanent position "will be tenable; but on the old system the one great difficulty was "to obtain a sufficient weight of small-arm fire at certain points; for "instance, salients and flanked angles. With the mitrailleur, this "difficulty disappears, for by it, the actual value of 120 men can be "compressed into the standing-room occupied by four, and with only "the exposure to fire of three of these."

This article was written before experience had proved a rate of fire of more than 10 rounds per minute to be obtainable from the Montigny mitrailleur, which has been assumed as the basis of calculation: with 12 rounds a minute, the argument would be still more in favour of the arm. In any case the intermediate place which I propose to assign to the weapon is contended for, and its adoption would be borne out by any further confirmation of the truth of these views, which it is to be hoped may soon be obtained from experiment. It is not, as I have already said, that we could hope to replace by such instruments a single field gun, but that those who in addition to their full complement of artillery shall carry into the field mitrailleurs also, and understand their position and true uses, will obtain an advantage which I should be sorry to see possessed only by that side to which I found myself opposed.

From a clever pamphlet on the mitrailleur, written for Colonel Claxton, by some foreign engineer, I translate the following passage:—

"Power will no longer exclusively be on the side of the big batta- "lions, but as machinery has rendered industry rich and prosperous, "so now whilst diminishing, or at least without increasing a war ex- "penditure, it is about to render small peoples and little states as "powerful for defence as are the great for attack."

Though I do not agree to the full in this statement, and should hold that to employ the mitrailleurs purely as defensive weapons would greatly detract from their value, still it touches on one of the most important sides of the question; namely, the multiplication of fire by mechanical means, and the saving of life and money so effected.

In conclusion, I must express my regret that I should have been unable to read instead of printing this paper, as the discussion which might have fairly been expected to follow, could not have failed to prove more instructive than my own deductions from the facts which I have had the honour to lay before my readers.

It was in contemplation of some discussion on the subject that I prepared much of this matter. For, even though it is well known that the French are in possession of many of these weapons; that almost every power in Europe has experimented with them; that Russia has ordered a large number, some of which she proposes to carry on the tops of her iron-clad ships of war;—attention has hitherto been but little directed to them in this country, and a valuable discussion tending to this object would be better provoked by a statement of the facts on one side, put as plainly as may be, than by a better balanced summary of every argument on both.

Thus I have not desired to dogmatize, but rather to put forward for consideration and discussion such points as seem to me to bear on the main question, seen from one point of view. Their position in the field I have endeavoured to show. Naval men will judge for themselves of the value of such inventions, securely sheltered and worked by a couple of men, in protecting the decks of their ships as contrasted with the huge and cumbrous rifle towers which some of them now carry. In repelling armed boats or sweeping an enemy's deck, their use would be, if exceptional, at least evident; and there are both on sea and land numerous positions where a fire such as that I have described would be most valuable, other than those I have enumerated or hinted at.

The invention in its present state is a comparatively new one, and like all new things will find many opponents simply because it is so, whilst the *status quo* will never want an advocate. Those who will divest themselves of this very natural prejudice will, I trust, see in it some points of value rendering it worth, at all events, patient investigation, and be careful, whether in its adoption or rejection.

There are other details regarding it which could hardly have been introduced into a paper like this, but which may be gathered from reports of mine on the subject placed at the disposal of this Institution by the kindness of Her Majesty's Government. There are several improvements, or suggestions for its improvement, which I should have been glad to have made, had time and opportunity been granted me, while the invention was still under trial.

But if I regret that after two years' work and study of the subject, my connection with it now ceases, at perhaps the most critical and interesting time, it is without the selfish complaint of *sic vos non vobis* that I leave it, but honestly desirous of seeing that which I believe likely to prove of advantage to my country perfected and adopted, to whomsoever may eventually belong the credit of its introduction.

SUGGESTIONS FOR THE LAND TRANSPORT SERVICE OF THE ARMY.

By GEORGE G. BEAZLEY, Captain 83rd Regiment.

"A veteran army indeed, kept constantly ready for marching is expensive, yet it gives a State the disposal of things among its neighbours, or at least procures it a great reputation in other respects."

"It was a just answer of Solon to Crœsus, who showed him all his treasure: 'Yes, sir, but if another should come with better iron than you, he would be master of all this gold.'"

LORD BACON.

So many schemes connected with the management of the Army have lately been proposed and discussed, that it would seem almost needless to bring forward another. They have, however, chiefly referred to the subject of recruiting. This has been pretty well exhausted. Most persons who have attentively considered the matter have probably arrived at the conclusion that we can only compete with the armaments of the Continent by the introduction of a modified conscription, and the gradual abolition of the militia, yeomanry, and volunteers for a really effective Reserve, composed of men who have served a few years in the regular Army.

The object of the present paper is not to treat of recruiting, but to deal with the equally important subject of transport, touching incidentally on the defence of this country—vital questions, on whatever system men may be raised for military service. The British Army, though in many respects well organized, stops short of completion. We have regiments perfectly drilled and equipped; yet beyond their clothes, arms, and accoutrements, they have little that they require in the field. To move them entails numerous returns and much correspondence. To collect and place even a small force in the field to meet the enemy would, as there is little or nothing ready in the way of transport, be a matter of some difficulty. To obviate this defect, and remove the attendant delay and uncertainty, is the aim of the following plan.

Any proposal connected with the organization of an Army divides itself into two distinct branches, namely, the organization required for war, and that required for peace.

Although the former is the really important branch, yet peace being the normal condition of armies, it is impossible to devise a plan for

the one without considering the other. The question then is, how to be prepared for war at a moment's notice, without unnecessarily depriving Officers and men, during peace, of the ordinary advantages and comforts enjoyed by the citizen.

The outline plan which follows, applies chiefly to the Infantry; but, with certain self-evident modifications, includes the other arms of the Service, and is intended, in a great measure, as the basis of a scheme to ensure this country against surprise by invasion.

Since the regimental system of the British Army has been pronounced perfect as far as it goes, and since it is the system the most suitable to our wants, why not, instead of engrafting upon it modifications of Continental plans, endeavour to render it complete?

The Unit.—It is therefore proposed that the regiment should be made the unit of efficiency. That all transport, certainly of the first reserve of stores, and second of ammunition, should be organized upon a system based on the requirements of a regiment, and not on the wants of a brigade or larger unfixed unit.

To carry out the above idea, a regiment must be a fixed, distinct, and independent body, self-reliant for (1) transport, (2) food, (3) shelter, (4) clothing, (5) regimental and first reserve of ammunition, and (6) hospital.

Regimental Train.—The first thing to be provided is transport. In this country waggons are the most suitable. These waggons should be so constructed that without unloading they could travel on the railway trucks. As they would be in charge of the regiment, they should be marked with its number, the letter of the company or companies, or name of the department to which they belong. On the march they would follow the regiment, brigade, or division, in charge of men of the regiment, who should walk or drive, but not ride.

The *minimum* amount of tentage, baggage of Officers, tools and implements, arm chests, squad bags, reserve ammunition and *impedimenta*, including regimental hospital equipment, *absolutely required in the field*, would have to be fixed as to size, shape, and weight. These points being settled, the number of waggons to be allotted to each regiment would be determined.

In time of peace, contractors would supply the horses and harness at fixed rates, and possibly the same arrangement might be the most economical in time of war. Cast artillery, and cavalry horses, which sell for little or nothing, might be made available, if it were considered desirable to maintain the nucleus of an independent system; one or two horses to a regiment, for instance. Oxen should not be overlooked; they cost less, require little harness, move fast enough, are easily conveyed by railway, and when old, or in case of emergency, could be eaten. How far the employment of traction-engines could be used with advantage might be worthy of experiment.

It has been urged that waggons would not be required in England, as the railroads would furnish all the necessary conveyance. Though railroads would greatly facilitate the movements and concentration of troops, it is clear that were the line, bridges, or viaducts destroyed, or the post to be occupied only a short distance from the station, it would

be absolutely necessary to have the baggage brought up. For real efficiency, therefore, it may be assumed that the waggons could not be dispensed with.

To diminish the baggage now carried about by Officers, barrack-rooms should be furnished with all the articles required beyond the ordinary field kit.

All private baggage in time of peace should be moved independently of the regiment, by private carriers, as at present.

Food.—Instead of butchers and bakers being formed into one corps under a civil department, each regiment should have its own, liable to do military duty when not required in the exercise of their trades. These men would work in regimental, brigade, or divisional abattoirs and bakeries, receiving while so employed substantial working pay. In the event of misconduct, or the departure of a corps, all men so engaged away from their regiments, would rejoin.

Regimental Clothing.—A moderate supply of the most essential articles (such as boots, gaiters, socks, and flannel shirts) should accompany the regiment, a minimum being fixed for field service. These would have to be replenished as opportunities offered. The bulk of the Quartermaster's stores, would, in time of peace, have to move with the private baggage, or be left in charge of the depôt on the regiment going under canvas.

Regimental Ammunition.—The regimental reserve of ammunition (30 rounds per man), which might with advantage be considerably increased, should be divided among, and carried with the company's baggage, unless the regulation-means were provided.

The first reserve of small-arm-ammunition, now carried by the Royal Artillery, should be in a separate waggon, containing the necessary means for distributing it in difficult ground.

Regimental Hospital.—Medical Officers should be formed into one corps, and one, two, or three, according to the exigencies of the Service, attached to a regiment. The hospital should be entirely regimental, and all drugs, instruments, stores, and comforts should be drawn direct from the medical stores by the Surgeon doing duty with the regiment.

Though the Surgeon would not belong to the regiment, or adopt its uniform, he would be under the orders of the Commanding Officer, and in every way responsible for the thorough efficiency of his own department.

General Hospital.—Wounded men, and men too sick to travel, would, as now, be left in General Hospitals, established in garrison towns, or at the different depôts on the lines of communication. Only the Regimental Hospital, with the simplest cases, should move with the troops.

The Army Hospital Corps should be disbanded, their duties being always performed in regimental hospitals by trained soldiers of the regiment; in General Hospitals in garrison towns (during peace) by similar men from the several corps serving therein; in war time, by civilians, men or women, supplemented by disabled and convalescent soldiers.

In order to obviate any inconvenience which might arise from sick-

ness, misconduct, or furlough, every regiment should have a considerable number of men trained as drivers, butchers, bakers, and hospital orderlies. The last, as well as all bandsmen, should be trained at Netley, and be thoroughly instructed in ambulance duties. All such men, when thus employed, should receive a moderate daily sum, in addition to their pay.

So much for the regimental arrangements. Should such a scheme, or a modification of it, ever be adopted, it is evident that the responsibility of Officers commanding regiments and companies would be materially increased. Every Officer commanding a regiment would be bound to keep it fully equipped, and up to the regulation standard of efficiency. For this purpose he should communicate *directly* with all the departments of supply in all matters not involving maintenance, exchange, or expenditure beyond the recognized equipment.

Supply Departments.—The Supply Departments are the Commissariat, the Store, the Paymasters, the Barrack, the Purveyors, and the Medical.

In view of the proposed plan, the union of the first four departments under what is termed the "Control System" would not be desirable; they should be kept separate. Their duties are perfectly distinct; they have nothing in common. A Controller is only acquainted with the department to which he originally belonged; consequently, when referred to on a subject out of that sphere, he would be obliged to forward the correspondence to the branch of the control concerned. Thus, in most cases, the control system would only add another channel of communication to those already in existence. The only real control required would be that exercised by the War Office on the part of the Treasury. The Officers of the supply departments, therefore, while under the authority of the senior combatant Officer for the correct discharge of their duties generally, should—both for the benefit of the public purse and their own support and security—be accountable to the War Office for their expenditure. To prevent unnecessary reference, a clear code of regulations should be drawn up for the guidance of each department, and the Army generally. Such rules would, however, be liable to be set aside by General or other Officers commanding independent bodies of troops during war.

Paymaster's or Accountant's Department.—The Paymaster's Department, representing, and communicating directly with the War Office, would have sole charge of the financial arrangements and the military chest. From it, as from a bank, all money required by Regimental Paymasters, or departments, should be drawn.

The Purveyor's Department.—The Purveyor's Department should be abolished, and the duties of these officers, as far as the care and distribution of medicines and comforts are concerned, be entrusted to medical officers of different grades, on additional or Staff pay. This would tend to the unity of the Medical Department.

The Barrack Department.—However opinions may differ as to the advisability of bringing several distinct departments under one head, there can be little doubt that, for such a scheme as the present, the

Barrack Department should be retained as a separate branch of the Service. Although barracks might, and indeed would be, frequently occupied in time of war by the regulars or reserves, they are, nevertheless, the natural home of the soldier during peace. Here the recreation-rooms, libraries, schools, workshops, and canteens are established. These cannot, even in a modified form, accompany the troops on active service; they, with the barracks, are stationary, and are pre-eminently adapted only to peaceful times. The Commissariat, Store, Medical, and Paymaster's Departments, on the other hand, must be with the troops, whether in barracks or in the field. This distinction seems to point clearly to the necessity of maintaining the integrity of the Barrack Department as a separate establishment. This principle admitted, it would be desirable that the Barrack-masters should be selected from Engineer or other Officers, who having a taste and aptitude for construction, might be willing, for the sake of a fixed home, to relinquish their military career—retaining, however, if they wished it, honorary rank.

They should have charge of all permanent military buildings and property, including hospitals, libraries, schools, books, recreation-rooms, canteens, furniture, *and all implements not required in the field.* The construction of new barracks, all additions to, improvements and repairs of old, should be carried out by them, either by contract or military labour.

Thus the Officer of Engineers would be relieved of all duties connected with the construction and repair of barracks, and be enabled to keep up the special knowledge required of him on service.

There should be a store in every barrack for the private baggage of Officers, and the surplus of Officers' and Serjeants' messes; so that when the regiment encamped for the periodical summer drill, the rooms might be handed over to the Barrack-master either for repairs or for the occupation of another regiment.

Departmental Trains.—The Regimental Trains having been provided for, we now come to the consideration of the transport required by the different departments attached to the Army. This should be divided into the following branches:—

1. The Store Train, including (*a*) Artillery reserve stores and ammunition; (*b*) second reserve of small-arm ammunition; (*c*) saddlery and harness; (*d*) spare tents; (*e*) spare carriages for all arms.
2. The Clothing Train (this might, perhaps, form part of the Store Train), with similar supplies to the Regimental Train.
3. The Engineer Reserve Train.
4. The Paymaster's Train.
5. The Medical Train, with all the medicines and appliances required to replenish regimental consumption and losses, and to establish temporary general hospitals in the event of an engagement.
6. The Commissariat Train.

The Trains above detailed (1 to 5) should always be kept up, and the waggons be more or less ready packed, on a plan based upon the wants of a regiment or battery. This portion of the train—which for the sake of distinction we will call No. 1—should be that

which would move with the column to which it might be attached. The train to supply it with stores and ammunition, as expended, should consist, as must ever be the case, of the civilian transport available at the theatre of war, such as railways, carts, mules, or water carriage. No great difficulty could be experienced in fixing upon the amount of carriage required for No. 1 train, so as to enable a force to fight one or two battles without replenishing.

Commissariat Train.—To estimate the transport required by the Commissariat Department is a more difficult problem. The daily necessity of supplying food and fuel, and that bulky requisite, forage, and their collection from the neighbourhood, or transport from the depôts in the rear to the point of issue, depending on inconstant data and varying circumstances, render even an approximate calculation uncertain. It may, therefore, be assumed that even No. 1 Commissariat Train would, on war breaking out, be supplemented more or less by contractors' and vendors' carts.

The Regimental Trains could always, when the men were encamped and their waggons consequently empty, convey their supplies from the Commissariat point of issue to the respective camps. If necessary, a special or spare waggon might be used for that purpose. In brigade, regiments should furnish one waggon or more daily, in turn, for the use of the whole brigade.

Paymaster's Department Train.—The strength of the Paymaster's train would vary with the nature of the money in circulation. Even if the latter consisted principally of gold or notes, a considerable sum would have to be in small coin, to meet the wants of the soldiers. In the United Kingdom this train might, from the facilities of obtaining money, be dispensed with, provision, of course, being made for the office books.

All these departments—essential as they are for the efficiency, and even the existence of the Army—require men of business, and not military men, to ensure the objects for which they are created. They should, therefore, be strictly civil in their nature. And here another difficulty presents itself—Who is to have the control and authority over the different trains? This is a question not easily answered, for if the men composing them were soldiers, how would military discipline and order be maintained?

That each department—especially the Commissariat—ought to have control over the whole of its own duties, both in collecting and delivering its supplies, cannot be doubted. If its Officers were to have the whole responsibility they would be more independent, more punctual, and efficient; they could time and arrange their measures so as best to meet the varying difficulties they would constantly have to encounter; and while much correspondence would be saved, the issue of food and forage would be far more satisfactory in the long run, than if the duty of delivery were performed by a separate branch of the Service. These remarks apply in a less degree to the other departments.

Assuming that the horses, or oxen, waggons, and harness (the two latter of the plainest pattern), would be in the charge of the different departments, it only remains to provide the drivers.

Drivers.—To meet this difficulty there would appear only one or two ways. One would be to have a corps of drivers, under Officers and Non-commissioned Officers, subject to the Articles of War, but non-combatant. These men should drive, or walk, but not ride; they should be dressed in a simple working suit; be bound to help load or unload; and make themselves generally useful. In time of war they should be armed with a revolver only. Though they would be quite distinct from the Army, discipline should be maintained on the Army system. The detachment of these men required by a department for No. 1 train, would be under an Officer or Non-Commissioned Officer, according to its strength; the Officers, Non-commissioned Officers, and men, while so employed, being bound to obey the head of the department to which they were attached. In fact, the corps should be a body of useful, willing, working men, not above their work, with nothing whatever of the Dragoon about them—as unlike the present Military Train as light is to darkness. To compensate the Officers and men for their anomalous position in a military point of view, it would be necessary to pay them well. They should only be taught to drive, park, and pack their waggons—no drill or instruction beyond this would be necessary. The Officers, of whom there need be few, should be mounted. Non-commissioned Officers should drive, walk, or have a seat on the rear waggon, or, when there were more than one, on the front and rear waggons of the portion of the train in their charge. Such a corps should not consist of volunteers from other regiments, as they would at once bring into it the military element, which from its very nature and duties would be objectionable. A few sensible Non-commissioned Officers (who should be made thoroughly to understand that they would, on joining the corps, have to relinquish much of their "smartness"), might be necessary at first, to establish the interior economy of the barrack-room. Such a body in time of peace would probably be only a skeleton corps, but, the duties being simple, no difficulty would be found in augmenting it on very short notice, as the trained men would soon instruct the recruits. Men might be enlisted for such a corps for short periods, the pay being a sufficient inducement.

The other plan would be to have a similar corps under the command of the Officers, clerks, and issuers of the Supply Departments. These men, being simply drivers, would be interchangeable among the departments, according to the requirements of the different trains. Their distribution would be determined by the Transport-Director and Quartermaster-General's department. If, however, it should be considered advisable to keep the supply departments distinct, and complete in every respect, then each corps should have its own body of drivers. If the extra work thus entailed were not an insuperable objection, either of the plans, but especially the last, would probably prove the most efficient in practice, as each department, being complete and independent, all collision of authority would be avoided. It would also assimilate with the regimental system already proposed.

Transport Directors.—We have now provided for the regimental and departmental trains. To avoid confusion on the line of march, it would

be necessary to place them in charge of an executive Officer. With a large train, Brigade, Divisional, and Corps Transport-Directors would be required. The senior of these Officers with the force, would receive his orders direct from the Quartermaster-General's Department. Being invested with supreme authority during the march, he would be responsible for the correct movement of the whole. Officers so employed would require considerable tact and ability to deal efficiently with rival interests; and, while enforcing strictly the rules and customs necessary to secure the uninterrupted movement of the trains, ought to have the power as well as the judgment to know when to relax them. If a special and separate corps of drivers were established, the above duties would devolve on the Officers of that corps. The Transport-Directors should alone have the power to halt or move the line of waggons; the Officers commanding the escorts having nothing to do beyond defending them in case of attack.

No. 2 Train.—The train communicating with No. 1 and the base should be organized on a similar plan, but, with the exception of the Transport-Directors, should consist of civilians hired for the time being. It is not much more difficult to bring up stores and supplies for an Army than for a large city, as long as the communications are not threatened or attacked.

In the United Kingdom and in many other countries, the second train would be furnished by the railways; the regimental and No. 1 trains would be able to bring the supplies up to the front from the depôts established at the railway stations.

Summary.—We thus have a transport system, where the regimental trains, driven by soldiers only, would be employed with the troops in the presence of the enemy, or where military discipline is most required; behind them would come the departmental trains, and their disciplined non-combatant drivers, while in the rear of all, and out of danger, would be No. 2 train, manned by civilians.

Each train while in camp would be comparatively independent, and at the disposal of the regiment or department to which it belonged. On the line of march all would be under the Transport-Directors. Thus would be combined the advantages in camp, which a certain amount of freedom would give, with the order and discipline on the line of march absolutely requisite to ensure the unbroken progression of the whole.

Districts.—Reverting to the defence of this country it would be necessary to re-divide the whole kingdom with reference to the railway system, into military districts, to be placed under General Officers, who should command the whole of the troops, both regular and reserve. The head-quarters and a fortified magazine should be at or near the chief railway station, or at an important junction, connected, if necessary, by a branch with the main line. At this secure point all the transport and stores for No. 1 Train of the regular troops, and the stores for the reserves of the district, should be accumulated, as well as a sufficient supply of all equipment, to make good regimental losses, breakages, and expenditure.

About eight or ten districts in Great Britain, and four in Ireland, would probably suffice. These being in direct communication with the Government arsenals, would be easily kept supplied with all the stores required. The districts should be so arranged that each should include a portion of the sea-board. Suppose, for example, that England were divided by radial lines, following the boundaries of counties, drawn from a point near Tamworth to the coast; or, for simplicity's sake, into four, by two lines, one from Hawick in the north to Southampton in the south, the other from Milford Haven to Holbeach. The respective head-quarters might be established at or near Chester, York, London, and Gloucester. This, though only intended as an illustration, would give each a portion of the sea-board to guard.

Provision has now been made for the active Army, or *first line*.

1*st Reserve*.—The *second line*, or first reserve, should be organized on a similar plan, substituting the agricultural carriage available. All such carriage should be apportioned (a law being enacted for this purpose), to the different Reserve regiments, so that each Commanding Officer should know to what farmer or job-master he would have to go for his transport. His stores he would obtain from the district magazine. Some delay would doubtless occur before the first Reserve would be ready to move, but in the mean time the active Army would be on the march fully equipped, giving the first Reserve ample time to prepare for the field.

2*nd Reserve*.—A similar scheme would hold good for the second Reserve. The remaining Reserve troops would be employed in holding the fortresses and towns.

Camps.—In the drill-season, regiments, both Regular and Reserve, should assemble at the different camps, and remain under canvas, during the periods allotted to brigade and divisional instruction. The present huts should, as they decay, be removed, and not replaced.

The regular regiments being in possession of transport, should assist the regiments of the Reserve in bringing their camp equipage to and from the railway stations; as it would not be desirable to call upon the agricultural carriage, except in case of danger from invasion. Failing this, one or two permanent buildings might be constructed at the camps, to hold sufficient camp-equipage to meet the usual summer demands of the Reserve forces.

In order to reduce expenditure, regiments, as a rule, should remain a year in their quarters, and only move out for their summer drills. The annual hire of horses for the regimental trains would not amount to much, provided the moves now so frequent, were limited to the above periods.

Whether it would be advantageous to extend the system proposed for the regiment, by forming a regimental unit, say of a wing, two companies, or even one, would depend upon the number of waggons a regiment would require, and the distribution of the equipment.

The more effectually to carry out the above plans, Commanding Officers of regiments should be relieved of a good deal of their present office work. The returns now rendered should be revised. All returns and

accounts of schools, canteens, and recreation-rooms, might stop at the regiment being, if necessary, periodically examined, either at the half-yearly inspection, or by some Officer or Department appointed to supervise the whole of these and analogous institutions.

Departmental Subordinates.—A certain number of men of superior attainments would be required as compounders, issuers, and storemen, for the medical and other departments. Such men should be subordinate to, and as a rule under the sole authority of the Officers of these departments. There would be no occasion to enlist them, simply because they would administer to the wants of the Army. They might be engaged on terms calculated to meet all that could be required of them in their civil capacities, and yet to secure a due amount of subordination to military authority.

Indeed it would appear advisable to organize the whole of the subordinates of the Civil Departments on a system adapted to their special duties, rather than on a military basis; the Officers of the respective departments being responsible for their efficiency, and for the maintenance of such discipline as might be expected and required. There is nothing military in providing food, clothing, pay, arms, and ammunition for an Army. Even in the treatment of a soldier either for disease or wounds, medical, not military science is required. All such men should therefore have no arms, except during war, when, in order to meet unforeseen dangers, they should be supplied with a revolver apiece. As such emergencies occur so seldom during a man's lifetime, they should not be trained as soldiers, beyond being taught the use of their weapon. It is not worth while to combine in one man two incongruous duties, one which he has to exercise daily, with another which he may never be called upon to perform.

Advantages of Proposed Scheme.—Such a scheme fully carried out would entail considerable expense at the outset, but it would ensure proportionate advantages and security.

If, however, the magazines were not fortified, or if their defences consisted simply of earthworks, thrown up by the troops, the outlay would be almost limited to the cost of the waggons.

The Store Department would be relieved of the main portion of their present charge, and their duties would be appreciably diminished, especially at the most critical moment, namely, the first alarm.

Every regiment would at all times be prepared, without a moment's hesitation, to march out of barracks, ready in every respect for a campaign. The depôt, school, women and children would remain behind. All the private baggage (materially diminished by the furnishing of barrack-rooms) and *impedimenta* not required in the field, would be stowed away in one of the spare store-rooms.

On any emergency, a brigade could be told off from a division, a division from a corps, a corps from an army. Particular regiments might be selected if needful. With the exception of the Commissariat, —and they should be fairly ready,—the Supply Departments would at once furnish No. 1 train, simply on being informed of the number of Batteries, Companies of Engineers, Regiments of Cavalry and Infantry composing the force. The waggons would, if the point of assembly

were distant and approachable by railway, be run on to the railway trucks, starting at once for their destination, or awaiting the order to move. Draft animals would either accompany them, or be directed to meet them on their arrival at the given point. Here the advantage of having the waggons packed according to the wants of the *unit* will be at once apparent.

It would ensure the greatest elasticity, by facilitating the increasing, reducing, or detaching a force, since the order alone would furnish sufficient information for the Officers commanding regiments, and the heads of departments, without further reference or directions.

It would give great independence in the event of regiments or brigades being cantoned in separate villages, as then the butchers and bakers could act for their own regiments, or, combined, for the brigade.

The troops in each district would be at once able to present a front, and oppose any landing on their sea-board.

Regiments could embark without delay for foreign service. If to take the field, their waggons and draft animals depending on the scene of operations, would or would not, accompany them. If for an ordinary tour of foreign service, the waggons and animals might be left behind, and their places supplied on disembarking by a similar set, or by a set adapted to the new station. If, however, mules were the only available means of transport—though the same organization could be retained—the great increase in the number of animals would necessitate the employment of a certain number of natives, even with the regimental trains.

It would facilitate the instruction of the troops, by enabling them to encamp during the summer drill, free of all encumbrances, precisely as they would be in active service.

The sum now annually expended in the maintenance of the wooden huts in the respective camps would be saved, and a portion of it would cover all the expenses for the hire of draft animals during the drill season.

The regiments would have the advantage of spending a great portion of the year in towns, instead of in the wooden huts, isolated from the public.

After the harvest, brigades, or divisions of the active Army, could manœuvre over extended areas, encamping in the fields, thus realising and practising the strategical operations incidental to real war.

The division of labour and supervision, obtained by the separation of the regimental and departmental trains, would give to each that individual interest which always tends to real efficiency, and would more than compensate, in practice, for any advantages which might be gained by the centralization of the whole transport in a single department.

The men of the departments being relieved of all parades, care of arms and accoutrements, their whole time would be usefully employed in their special duties. In short, fewer men would be required, and the revolver would meet all that could be required of these as armed men in time of war.

Were the scheme confined to regiments, a most important establish-

ment would be at once created, as with such a train, without *an extra Officer or man*, an Army, especially in the United Kingdom, could, on the first outbreak of hostilities, shift for a considerable period, if not altogether.

If the departments were unprovided with waggons, the stores, materials, and implements might still be arranged in the magazines, according to the wants of a regiment, ready to pack on any carriage available.

Conclusion.—In conclusion, though the plan I have ventured to propose may be crude, present many difficulties, have many defects in detail, and be open to criticism, it is submitted that, while in the main simple and practical, it fulfils the conditions set forth in the beginning, namely, those of securing the advantages of constant preparation for war, with all the benefits pertaining to peace.

PROCEEDINGS

AT A

SPECIAL GENERAL MEETING.

A SPECIAL GENERAL MEETING was held in the Theatre of the Institution, on Monday, July 5th, 1869, at 4 P.M., to consider the following proposed additions to the Bye-laws relating to Subscriptions, viz.:—

"That all Members joining the Institution on or after January 1st, 1870, shall be entitled to receive the Journal from the date of their becoming Members.

"They shall pay an Entrance Fee of £1, and an Annual Subscription of £1, whether they are at Home or Abroad; or they may become Life Members by a payment of £9 in addition to the Entrance Fee."

General LORD HOTHAM, President of the Institution, in the Chair.

I. The Secretary read the Notice convening the Meeting.

II. Rear-Admiral Sir FREDERICK NICOLSON, Bart.:—

Gentlemen,—the proposition which I have now to bring forward is one that comes before you with the authority of the Council. The object which I had in view in bringing the proposition originally before the Council was this:—It occurred to me that it would greatly simplify our accounts to make the subscriptions uniform, as at present we have two different classes of subscription. Again, the alteration would place the *Journal* in the hands of all the Members, instead of only in those of a certain number. I think the more our *Journal* is distributed, the more people will be made aware of the objects of the Institution; and the greater the advantages it will afford to the Members of the Two Services. I think the only argument against the proposition is this, Will it diminish the number of entries in future, will it keep away those who might become Members? If the Meeting will allow me to read a few figures, they will see that there is very little foundation for any fears on that head. The numbers who joined in 1866 were 126 Members at a pound, and 16 at ten shillings; in 1867, they were 97 at a pound, and 17 at ten shillings; in 1868, they were 136 at a pound, and only 28 at ten shillings; and from the returns up to the present time, I find that out of 111 who have joined the Institution since the beginning of the year, only 5 are Members at ten shillings, and only 1, a Life

Member at the lower rate of composition, that is, at £6. So I do not think we need have the least fear that if this rule be carried, we shall lose any number of Members. I hope it is understood by all present that the proposed step is not *retrospective;* it simply applies to Members who shall join on or after the 1st of January, 1870; therefore it will not affect any Members who already belong to the Institution. With regard to the proposal that Members abroad should pay the same amount as Members at home, I may likewise mention that this will affect but a very small number. Our present rule is this, that any Member who pays one pound a-year at home is entitled to the *Journal;* and if he goes abroad on service he is allowed to reduce his subscriptions to ten shillings a-year, and still to receive the *Journal*, on giving notice of his wish to that effect to the Secretary. I find from the returns in the office, that the number of Members who have reduced their subscriptions from one pound to ten shillings, on going abroad, is only 15 in three years; an average of 5 Members a-year who have reduced their subscriptions. I am really not aware that it is necessary to detain the Meeting any longer upon this point. Members who have looked minutely into the accounts must know the complication that is caused by having so many different rates of subscription. In due course of time, as the old Members die out, and we get fresh Members to replace them, as I hope we shall do in equal numbers, this proposal will increase our revenue by somewhere about £500 a-year. At present the number of Members paying ten shillings a-year, is about 1,100. I feel confident that young men joining the Institution will not hesitate to pay one pound; they will willingly pay the pound remembering that for that one pound they will get the *Journal.* I will now move the resolution, but before doing so, I may add that I propose that the new paragraph should be inserted after paragraph 7, Section IV. of the Bye-laws. I do not propose that any alteration be made in the existing laws, because those laws still apply to those already Members. The simplest way, therefore, will be to insert this as an additional paragraph after paragraph 7. It will read as follows:—

"All Members joining the Institution on or after January 1st, 1870, shall be entitled to receive the *Journal* from the date of their becoming Members.

"They shall pay an entrance-fee of £1, and an annual subscription of £1, whether they are at home or abroad; or they may become Life Members by a payment of £9 in addition to the entrance-fee."

General Sir William Codrington, G.C.B.:—

I beg to second the resolution which has been proposed by Sir Frederick Nicolson. It has received the consideration of the Council, and is now brought forward by their direction. Of course, it is for this Meeting, convened as a Special General Meeting for the purpose, to decide the question. The *Journal* being an expensive as well as a very valuable publication, I do not think there are any Officers who would really wish to reduce their subscriptions to Ten Shillings and yet receive it free, when the additional Ten Shillings would be of such an advantage to the Institution. I really do not think there is any more to be said on the subject, and it only remains to submit the proposal to this Meeting for their approval and confirmation.

Major-General Boileau, F.R.S.:—

I have great pleasure in supporting this resolution, because I go heartily and entirely with the mover and seconder of it. The subject was brought before the Council several times during the period I had the honour of sitting at the Board, and it always received my concurrence. I believe, indeed, on one occasion, I myself brought forward a proposition that the subscription should be increased to £1. It appears to me that the question is entirely one-sided, that there is nothing to be said against it, and everything to be said in its favour. First of all, it will equalize the subscriptions, which will be a very desirable change; secondly, I consider that every Member of the Institution ought to have the privilege of paying the same sum, and of receiving a copy of the *Journal.* The *Journal* is very expensive, and I have never considered it a favourable arrangement for the Institution, that a man

subscribing ten shillings and going abroad, should have the privilege of taking the *Journal;* or, subscribing ten shillings at home, he should not be privileged to receive it. I think we ought to make everything equal in an Institution of this kind: first of all that the subscriptions should be equal, which would very much simplify the Accounts; and, secondly, that every Member should participate in the entire advantages of the Institution. On those two grounds, I beg to say that everything that has been proposed has my concurrence. I might say one word with regard to the payment of Life Subscriptions. The sum of £9 seems to me, calculated as it should be upon the duration of life, to be a sum very much less than Members securing a life-interest in the Institution ought to pay. But it has been for some years the rule, and is still the rule. I will not make any objection or propose any amendment upon that point. But I do submit, with all deference, for the consideration of the Council, as an actuary, that this sum of £9 is very much less than persons entering the Institution, especially those who are young in the Service, ought to be required to pay. The probable duration of life of a man entering the Army is from twenty to thirty years, so that there is a loss of £20 upon a £9 payment, which does not bear compound interest, because these sums are funded and the interest is applied to the current expenses of the Institution. Therefore, in giving my hearty concurrence to the proposal, I would respectfully ask the Council to take the question of Life Subscriptions into their consideration at some future time.

The CHAIRMAN having put the Resolution, it was carried.

A discussion subsequently arose on the following points raised by Captain Tyler, viz., to insert at the end of par. 7 the words, "the above rules shall apply to all Members joining before the 31st December, 1869:" and secondly, that pars. 3 and 4 should be altered so as not to conflict with the rule just passed. After considerable discussion, at the suggestion of the Chairman, it was decided that the resolution as originally moved should stand, and that if between the period when the new rule would come into operation and that of the next Annual General Meeting, any inconvenience should be found to result, or if it were found desirable to make into one the several paragraphs relating to subscriptions, the question should then be brought forward and dealt with.

The CHAIRMAN then announced that the business of the Meeting was concluded.

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VOL. XIII. 1870. APPENDIX.

PROCEEDINGS OF THE THIRTY-NINTH ANNIVERSARY MEETING.

THE THIRTY-NINTH ANNIVERSARY MEETING of the Members was held in the Theatre of the Institution, on Saturday, the 5th March, 1870.

The Right Hon. EDWARD CARDWELL, M.P., Secretary of State for War, in the Chair.

I. The Secretary read the Notice convening the Meeting.

II. The Minutes of the Thirty-eighth Anniversary Meeting were read.

III. The Annual Report of the Council was read as follows:

1. THE COUNCIL have the pleasure of submitting the Thirty-ninth Annual Report.

MEMBERS.

2. During the year 1869, one hundred and sixty five Members joined the Institution. The Council regret to record the loss by death of ninety-eight and by withdrawal of fifty-nine. The names of twenty-eight have been struck off the lists, their subscriptions having been unpaid for two years and upwards. The loss on the year therefore amounted to twenty.

A detailed statement of the changes in the list of Members, and a tabular analysis of the past and present state of the Institution, will be found on pages 11 and 12.

FINANCE.

3. The usual Abstract of the Yearly Accounts, as audited on the 3rd February, will be found on the following page:—

GENERAL ABSTRACT OF THE ACCOUNTS OF THE ROYAL UNITED SERVICE INSTITUTION, FROM 1st JANUARY to 31st DECEMBER, 1869.

EXPENDITURE.

	£	s.	d.	£	s.	d.
Secretary's Salary				250	0	0
Ditto Lodging Allowance				50	0	0
Librarian's Salary				104	3	4
Accountant's ditto				100	0	0
Clerk's ditto				62	0	0
Servants' Wages				378	12	9
Ditto Clothing				46	9	6
Insurance				20	5	0
Ground Rent				200	15	10
Fuel				57	7	6
Lighting				43	4	10
Annuity to John Pitt				20	0	0
Assessed Taxes				48	3	5
Income Tax				5	0	0
Parish and Water Rates				110	12	6
Artificers				167	14	8
Museum				84	10	9
Library				245	8	6
Topographical Room				1	15	0
Advertisements				46	10	6
Printing Circulars and Stationery				94	13	5
Lectures				32	14	0
Journals, including Annual Report and List of Members				879	0	5
Postage { Journals	163	13	9			
Postage { Letters	45	10	10			
				209	4	7
Loan of Exchequer Bills				5	9	0
Expenses consequent on the Coin Robbery				119	8	11
Miscellaneous				41	14	7
Balance of Petty Cash returned to Bankers				18	5	7
Total Expenditure				£3,443	4	7
Cash repaid to Agents				9	12	3
Charges from ditto				0	11	6
Invested in purchase of £257 9s. Consols				237	0	0
Interest paid on purchase of £1,000 Exchequer Bills				3	15	4
Balance at Bankers, 31st December, 1869 { Income	227	10	0			
Balance at Bankers, 31st December, 1869 { Life	18	0	0			
				245	10	0
Total				£3,940	3	8

Examined and found correct. 3rd February, 1870.

{ H. F. DOWNES.
{ J. E. A. DOLBY.

RECEIPTS.

	£	s.	d.	£	s.	d.
Balance at Bankers, 31st December, 1868				180	19	10
Annual Subscriptions, at 10s., for 1869	474	1	0			
,, ,, above	1,873	13	0			
,, ,, arrears	15	10	0			
,, ,, advance	5	10	0			
				2,368	14	0
Entrance Fees				165	0	0
Donations				3	0	0
Dividends				207	6	10
6 months' Interest on £1,000 Exchequer Bills				12	3	9
Sale of Journals				109	15	4
,, Waterloo Pamphlets				0	18	0
,, Waste Paper				12	12	0
Interest on £1,000 Exchequer Bills sold				5	18	4
Government Grant				600	0	0
Balance of Petty Cash returned to Bankers				18	5	7
				£3,684	13	8
Balance of Life Subscriptions at Bankers, 31st December, 1868				17	0	0
Life Subscriptions, received during 1869				238	10	0
Total				£3,940	3	8

GEO. FELSTEAD, Accountant.

Estimate of Receipts and Expenditure for the Year 1870.

Expenditure.	£	s.	d.
Secretary's Salary and Lodging allowance	300	0	0
Librarian's Salary ..	100	0	0
Accountant's „	100	0	0
Clerk's „	62	0	0
Servants' Wages	400	0	0
Ditto Clothing ..	50	0	0
Insurance	11	5	0
Fuel	60	0	0
Lighting	45	0	0
Ground Rent	205	0	0
Annuity to John Pitt ..	20	0	0
Assessed Taxes & Income Tax	145	0	0
Parish and Water Rates	110	0	0
Artificers, Repairs, &c. ..	150	0	0
Library and Topographical Department	170	0	0
Journals	850	0	0
Postage thereof	160	0	0
Museum	200	0	0
Advertisements	50	0	0
Lectures	40	0	0
Printing Annual Report and List of Members ..	80	0	0
Printing Circulars, & Stationery	90	0	0
Postage	60	0	0
Sundries	50	0	0
Balance ..	139	5	0
Total.. ..	£3,647	10	0

Receipts.	£	s.	d.	£	s.	d.
Balance at Bankers, 31st Dec., 1869				227	10	0
Annual Subscriptions:	£	s.	d.			
At 10s. ..	450	0	0			
Above ..	1,900	0	0			
				2,350	0	0
Entrance Fees				150	0	0
Dividends				230	0	0
Sale of Journals				90	0	0
Government Grant ..				600	0	0
Total.. ..				£3,647	10	0

Examined and found correct. 3rd February, 1870. { H. F. DOWNES. J. E. A. DOLBY.

Life Subscriptions.

4. Life Subscriptions amounting to £237 10*s.*, including £17 not invested last year, have been invested in Three per Cent. Consols. A balance of £18 remains for future investment.

Capital Account.

5. The funded property of the Institution, on the 1st January, 1870, was £6,653 17*s.* 8*d.*, as compared with £6,396 8*s.* 8*d.* on the 1st January, 1869.

Alteration in the Bye Laws relating to Subscriptions.

6. At a Special General Meeting of the Members held in the Theatre of the Institution, on Monday, the 5th July, the following resolution was passed, viz., "That all Members joining the Institution on and after the 1st January, 1870, shall be entitled to receive the Journal from the date of their becoming Members. They shall pay an Entrance Fee of £1, and an Annual Subscription of £1, whether they are at home or abroad, or they may become Life Members by a payment of £9 in addition to the Entrance Fee."

Lease of the Premises.

7. The Council regret that they are still unable to give the Members any definite information with respect to the tenure of these premises.

They do not however, anticipate that any change will take place during the present year.

Lectures and Journal.

8. The Lectures and Discussions of the past year cover a wide field of Naval and Military subjects. The sale of the Journal, which was greater last year than at any previous period, is the best proof that it maintains its high reputation. The Council tender their thanks to those gentlemen who have contributed so much valuable professional information.

Library.

9. Five hundred and sixty volumes were added to the Library during the past year. Of these 225 were purchased, and 335 presented. Among the latter, the following are the most prominent:—

By the Austrian Government—
The 4th and 5th volumes of *The War of* 1866.
By the Italian Minister-at-War—
The *Annuario Militare*, 1869.
,, *Giornale Militare*, 1868.
,, *Giornale del Genio Militare* (with Plates), 1863 to 1867.
,, *Giornale d'Artiglieria*, 1861 to 1868.
Reports by General Torre to the Italian Minister-at-War on the Conscription, from 1863 to 1866.
By the Netherlands Government—
60 Plates (Artillery Equipment.)
By the Russian Government—
Two numbers of the *Military Journal*, 1869.
Ditto *Engineering* ditto.
By the Government of Saxony—
17 Plates (Military Improvements.)

By the Swiss Government—

The Field Exercise for the Troops of the Swiss Confederation; also *Report of the Federal Military Department on its Administration in* 1868.

By J. Travers Smith, Esq.—

17 volumes of *Bulletins of the Campaigns*, 1793 to 1810; of which 2 volumes were retained for the Library of the Institution, and 15 volumes, being duplicates, were presented to The Prince Consort's Library at Aldershot.

By The Royal Institution of Great Britain—

73 volumes of *Navy Lists*, of which 34 volumes were kept for the Library; the remainder, being duplicates, were presented to the Royal Naval College at Portsmouth.

Esther Lady Radstock has presented a valuable collection of rare and interesting works (205 volumes), chiefly on Naval matters, from the Library of her late husband, Admiral Lord Radstock.

The exchange of Journals with Foreign Governments, and with various Scientific Societies in this country, has been continued; and a similar arrangement has been made with the Archæological Institute, and with the Editors of the *Revue Militaire Française*, and of *Professional Papers on Indian Engineering.*

The Library now contains 14,660 volumes.

Topographical Department.

10. His Royal Highness the Field Marshal Commanding-in-Chief has presented a set of Photographs, taken by the Royal Engineers in Abyssinia.

The Secretary of State for War has presented the Route Survey of Abyssinia; Lithographic Plates of the Manufacturing Departments of the Royal Arsenal at Woolwich; Photographs of Guns, Casemates, Shields, Targets, &c.

The Belgian Government has presented five Sheets of the Topographical Map of Belgium.

Lieutenant F. Bonnevie, Norwegian Royal Guard, Corresponding Member of the Institution, has presented the first Sheet of a Military Map of Norway; and Lithographic Views of the Cathedral of Drontheim.

Museum.

11. The additions to the Library and Museum will be found duly recorded in the Proceedings of the Annual General Meeting, and in the Appendix to Vol. XIII. of the Journal. To the following, however, the Council desire to draw the attention of the Members, viz.:—

1stly. A silver-mounted Shield, Sword, Spear, and curious War Implement from Abyssinia, presented, through the India Office, by Lieutenant-General Lord Napier of Magdala, G.C.B., G.C.S.I., &c.

2ndly. Trophies from Bhootan, consisting of Match-locks, Bows, Arrows and Quivers, Swords, Shields, &c., taken at the re-capture of Dewangiri by the 55th Regiment, under the command of Colonel Hume, C.B.; presented by Colonel Hume, C.B., and Major Hume, 55th Regiment.

The Uniform and Accoutrements of a Private of the Horse, and the Foot Artillery, 1st Dragoon Guards, and 10th Hussars, also the New Uniform and Accoutrements of a Soldier of the Line, have been deposited by the War Office in the Museum.

The Secretary of State for War has sanctioned an arrangement by which specimens of the improved Arms, Clothing, Accoutrements, and Military Stores, adopted into the Service from time to time, will be placed in the Museum.

In the Naval Department a series of Half-block Models (with diagrams of sections) illustrating the progress of Naval Construction, from the time of the screw line-of-battle ship to the present period, is in course of formation. These Models are being constructed by permission of the Lords Commissioners of the Admiralty in H.M. Dockyards at the expense of the Institution. Models of H.M. Ships "Howe," "Duncan," "Ariadne," "Warrior," and "Hercules," have been already received.

The thanks of the Council have been tendered to the Secretaries of State for War and for India, to the Lords Commissioners of the Admiralty, and to the various Donors, for their respective contributions to the Institution.

Vice-Patrons.

12. The Council have the pleasure of announcing that His Royal Highness Prince Arthur, K.G., and His Serene Highness the Prince of Teck, G.C.B., have become Vice-Patrons of the Institution.

They have also had the pleasure of electing Sir George Rose Sartorius, K.C.B., Admiral of the Fleet, and Field-Marshals Sir Alexander Woodford, G.C.B., G.C.M.G., and Sir William M. Gomm, G.C.B., Vice-Patrons.

It is with regret that they record the deaths of the following distinguished officers, viz.:—Field-Marshal Viscount Gough, K.P., G.C.B., G.C.S.I., &c., and Sir William Bowles, K.C.B., Admiral of the Fleet.

Honorary Members.

13. Several Officers of Foreign Services were elected Honorary Members of the Institution during their stay in this country.

Corresponding Members of Council.

14. On the 1st January, 1870, there were 306 Corresponding Members of Council, as compared with 279 at the same period last year. This increase is very gratifying, and the Council take the opportunity of the circulation of this Report to thank their Corresponding Members for their services.

Conclusion.

In conclusion, the Council congratulate the Members on the state of the finances and on the general efficiency of the Institution.

Sir Harry Verney, Bart., M.P.—

I have very great pleasure in moving that the Report which has just been read, "be adopted and printed for circulation amongst the Members." The last words read to us by our Secretary were: "In conclusion, the Council congratulate the Members on the state of the finances, and on the general efficiency of the Institution." Sir, I think that the efficiency of the Institution has been proved by the admirable papers which have been read to us during the past year, by the discussions that have followed them, and by the effect those discussions have had upon the general organisation and improvement of the Army. A wise Minister listens to what passes in this room, because he is aware that the Officers who take part in the discussions here are anxious for the welfare of the Army and the Navy, and are uncontrolled and uninfluenced by constituents or by any considerations but those which apply to the Services; therefore, I think that a Minister has a very great advantage in being able to know what passes here. In the discussions which here take place, Officers interchange opinions as to what they consider may be beneficial for the Services, and thus, quite freely and openly, subjects are discussed by those who have no other object than the good of the Military Services of the country. A wise Minister, therefore, reaps the greatest advantage from hearing what takes place in this room; and I must congratulate the Military Service that our Right Honorable Chairman has taken advantage of the discussions that have been held here by Officers of the highest authority, and has inaugurated that which, for my part, I believe will be the greatest boon and advantage to the Army; I mean "Short Service." Of course this is not the place or time to discuss the benefit or disadvantage of different proposals; but still I think I may be permittted to congratulate this meeting, that the discussions that have taken place here, have evidently told upon the mind of my Right Honorable friend, and that he has brought forward a motion and a proposal which, I believe, will be beneficial to the Service, and will certainly unite the army with civilians, with the whole body of the nation, in a way in which, up to this time, they have not been united. I must congratulate the country on there being an Institution like this; because, as we have sailors and soldiers in all parts of the world, we are able to collect scientific and political information of all kinds, and from this place as a centre, it can be made useful not only to the Services, but to the country at large. The great advantage which this Institution has been to the country, has been shown over and over again. Do not let us, however, suppose that we have nothing to learn

from foreign countries. We have a great deal to learn, not only as regards the Army and the Navy, but as regards the interests of the country at large. I am sure that those *best acquainted* with foreign countries will confess, that we have a great deal to learn *from* foreign countries. I recollect once being with an army of 40,000 men, every man of whom knew everything that a soldier ought to know. From every company, three men were told off for cooking, three for purchasing meat, three for buying vegetables, three to collect accounts, others to look over the accounts, and others for different sorts of objects. Why, surely an army constituted in that way must be the best army in the world. Such was the case with Napoleon's army at Boulogne, that army which won Eylau and Austerlitz. That was the most universally working army that Napoleon ever had, and they were the bravest and the best soldiers he ever had. Now, Sir, Marshal Bugeaud confessed, "The English Infantry are the best Infantry in the world; happily there are few of them"; but the few we have, ought to be rendered as efficient as possible, both Officers and men. This would make the profession more and more interesting; it would lead the feelings of the nation with our Army, and I say that every exertion ought to be made,—and I believe that the Right Honorable gentleman is now making them,—to render our small Army—very small indeed compared with those of Continental nations, small compared with the territories it has to defend, and the enormous wealth and the most important interests it has to protect,—as efficient as possible. I have much pleasure in moving the Resolution that has been placed in my hands.

Admiral Sir EDWARD BELCHER, K.C.B.—

I have great pleasure in rising to second the motion, "That the Report be adopted and printed." As one of the founders of this Institution, I may say that I see the advance that it has made, with very great pleasure. When it was first commenced, it was a mere museum; the different Officers in our Services were invited to contribute from the collections made by them in all parts of the world. At length it was found it would be more useful to convert it into what it is now, an Institution, where discussions on subjects connected with both Services, can be carried on. I am happy to see that year by year, the Institution increases, and I have hopes that it will ultimately be of very great importance to the Government.

The names of the eight Members retiring from the Council by rotation, were read as follows:—

Vice-Admiral R. COLLINSON, C.B.
Colonel Sir R. A. SHAFTO ADAIR, Bart., F.R.S.
Captain Sir SIBBALD SCOTT, Bart.
Lieut.-Col. H. C. FLETCHER, Scots Fusilier Guards.
Captain W. D. MALTON
General Sir WILLIAM. J. CODRINGTON, G.C.B.
Admiral Sir HENRY J. CODRINGTON, K.C.B.
Captain M. S. NOLLOTH, R.N.

Admiral INGLEFIELD, C.B., F.R.S.—

I beg to propose the Second Resolution, and in doing so I wish to express my agreement with what fell from Sir Harry Verney with respect to the advantage it is to a Minister holding the position you, Sir, occupy, to receive the information which comes from different members of the Services; but as Ministers do receive these advantages from us, so we hope that they will give us some advantage in return. The great object of this Institution now is, to obtain a permanent position in some Government building. I feel that this is an occasion when we can, Sir, draw your attention to this matter perhaps better than at any other time. With reference to the success of this Institution, there is only one point in the Report that appears to me which can be deemed hardly satisfactory, viz., that we have fallen off some twenty in our numbers. Now, I think if members will do what has been done so successfully in the Royal Geographical Society, that is to speak of the merits and advantages of the Institution among their brother Officers, we shall, probably next year, have to record a larger number of members than we can this year—only 165. In the Geo-

graphical Society a great number of men have been got together entirely by the different members pointing out to their acquaintances and friends the advantages of joining. Very few Officers in the Services would fail to join this Institution, if it was well known, that in this place Lectures are given upon scientific subjects,—that there is a large Museum and Library,—and that here they may meet with their brother Officers and discuss interesting topics. The Resolution that has been put into my hand is—"That the thanks of this Meeting be given to the Members of the Council who retire by rotation, and that the following Members be elected to fill the vacancies :—

Vice-Admiral R. COLLINSON, C.B.	For Re-election.	Col. A. H. LANE-FOX, late Grenadier Guards.
Lieut.-Col. H. C. FLETCHER, Scots Fusilier Guards.		Major-General Sir ANDREW S. WAUGH, Kt., F.R.S.
General Sir WILLIAM J. CODRINGTON, G.C.B.		Rear-Admiral J. W. TARLETON, C.B.
Captain W. HORTON, R.N.		Col. H. HUME, C.B.
Col. H. A. OUVRY, C.B.		Rear-Admiral A. P. RYDER.

The last two are as a reserve in case of vacancies occurring.

Colonel GOSSETT, R.E.—

It would be presumptuous in me to add anything to the excellent remarks tha have been made, and I therefore simply second the Resolution.

The Resolution was then put from the Chair, and carried unanimously.

General BOILEAU, F.R.S.—

The Resolution which has been put into my hands conveys a vote of thanks to the Auditors. This Resolution, which I shall read presently, must not be considered as the offering of a mere tribute of empty praise or as mere verbiage, to those who have performed the duties of Auditors: for, although the general abstract of accounts appears small, it really involves a considerable amount of labour and responsibility. Each of the lines necessitates a reference to a great number of items of detail, and it is the duty of the Auditors not only to scrutinise these accounts, but to examine the details, and to see that they correspond with the sums entered in the abstract. This duty is a very arduous one, as I can state from experience, and it is also a very reponsible one. I think, therefore, our best thanks are due to those who have undertaken this duty. The Resolution is—

"That the thanks of the meeting be given to the Auditors for their valuable services, and that the following gentlemen be elected for the ensuing year :—

Captain J. E. A. DOLBY, for Re-election.
H. F. DOWNES, Esq.
THOMAS SMITH, Esq."

Admiral Sir FREDERICK NICOLSON, Bart., C.B.—

I have much pleasure in seconding the motion. As a member of the Finance Committee I am well aware of the numerous details into which the Auditors must examine in order to do their duty towards the Institution in a thorough manner. I am happy to say, so far as I know, there have been no mistakes of any importance in those accounts. I cordially second the vote of thanks to the Auditors.

The Resolution was then put from the Chair, and carried unanimously.

The CHAIRMAN then announced that the business of the Meeting was concluded.

The Chair having been taken by General LINDSAY,

General STANHOPE said—

I have to ask for your kind thanks to the Right Honorable the Secretary of State for War, for the very able way in which he has fulfilled the duties of Chairman here this day. He, I hope, feels thoroughly the great use of this Institution, and I feel perfectly confident, that in the present Secretary of State for War we shall have a firm and constant friend, and one who will assist this Institution in every way in his power. I propose, Gentlemen,

"That the thanks of this Meeting be given to the Right Honorable the Secretary of State for War for his kindness in attending on this occasion."

Admiral Lord FREDERICK KERR—

I have very great pleasure in seconding the motion.

The motion was carried with acclamation.

The Right Hon. EDWARD CARDWELL—

Gentlemen, I assure you that it has given me the greatest pleasure to accept your invitation, and to have had the honor of presiding on this occasion. I feel extremely the importance of this Institution, and am very much impressed with the feeling which has been expressed in some speeches, namely, that the Government derives the greatest advantage from the labours of those gentlemen who contribute to the literature of this Institution. We live in a time when pure science, and applied science, and historical investigation, contribute probably more than at any former period, to the real progress of the Military Profession. It is, therefore, peculiarly useful at the present time, that the most able and intellectual members of the two professions should have a home where they can meet in friendly intercourse and honorable rivalry, for the purpose of discussing questions relating to their professions. Their doing so, ventilates those questions. Many of the most interesting subjects which afterwards occupy practical attention, find the first germs of their existence in the Lectures of this Institution; and according to what we read in the statements of modern philosophers, viz., that germs when they are weakly, perish soon, and no more is heard of them, but that when they are hardy and robust, they flourish into the light: so those germs become the origin of future practical measures, to be adopted by the Government and by the State. Therefore it is that I feel not only the general advantage of the Institution, but its peculiar advantage at a period like the present. It is your excellent practice not to have lengthened speeches, and I should wish to be the last of all men to violate that principle. Your scope is action and not talking, and I think I should not do well if I failed to observe your excellent rule. I would just make two remarks as a civilian. First, when I read all that science is doing, and all that the study of history is doing, the first thing that I rejoice in as a civilian, is to see that great as are the improvements in the arts of attack, if possible still greater are those which are made in the arts of defence. I trust that that honorable rivalry will be maintained, and I for one shall always rejoice when I think that the science of defence is still gaining on the science of attack. The next remark I wish to make is this: a great philosopher has said that all things go round in cycles, and I have been extremely struck when I have noticed how very much the progress of the most advanced science, seems to bring us back upon some of the footprints of history. In the Middle Ages, in order to protect themselves in war, men plated their bodies with iron; we do not do this in our days, but we are all occupied in considering how best to plate our vessels with iron. Going back to a still earlier period, we find when Julius Cæsar invaded England, earthworks and entrenched camps were designed by the military science of that day; we now find the most advanced science of modern days is carrying us back to the times of Cæsar. Nay, even in the smallest matters, we sometimes find this curious historical parallel. The first time I went to Pimlico to see the manufactory there, I found men engaged in a very ingenious manufacture of shakos from the bark of the cork tree, and I was amused to remember that Virgil describes Eneas as visiting a people whose headgear was made of cork:

"Tegmina quêis capitum raptus de subere cortex."

I assure you that I have had the greatest pleasure in presiding on this occasion. I do not know that I ought to condole with you on the prospect of being disturbed in your premises, because I sincerely hope that, if in consequence of any improvements that may take place in this neighbourhood, you are disturbed, the result may be that I may have the pleasure of seeing you in a more commodious place, and one in which your abundant treasures may be properly exhibited.

STATEMENT OF CHANGES AMONG THE MEMBERS SINCE 1ST JANUARY, 1869.

	Life.	Annual.	Total.
Number of Members, 31st December, 1868 ..	891	2,921	3,812
" " joined during 1869 ..	22	143	165
	913	3,064	3,977
Changed from Annual to Life	+6	−6	
	919	3,058	3,977
Deduct—Deaths during 1869 ..	19	79	
Withdrawals ..		59	
Struck off		28	
	19	166	185
Number of Members on 1st January, 1870 ..	909	2,893	3,792

To 31st of December, 1869.

Year. 1st Jan. to 31st Dec.	Annual Subs. received.	Entrance Fees.	Income (from all sources).*	Life Subs. received.	Amount of Stock.	Invested in the purchase of Books, &c.	No. of Vols. in Library.	No. of Members on the 31st Dec.	Number of Visitors
	£	£	£	£	£	£			
1831	654	..	654	1,194	..	..	..	1,437	..
1832	1,146	..	1,146	973	..	..	..	2,699	..
1833	1,405	..	1,450	692	..	..	..	3,341	..
1834	1,500	..	1,549	583	1,100	..	..	3,748	13,376
1835	1,480	..	1,574	366	2,430	40	..	4,155	8,537
1836	1,570	..	1,682	330	3,747	45	..	4,069	8,521
1837	1,549	..	1,747	222	4,747	180	..	4,164	10,907
1838	1,462	..	1,634	230	5,500	246	..	4,175	15,788
1839	1,399	..	1,565	168	5,500	292	..	4,186	16,248
1840	1,363	..	1,525	198	5,500	446	5,500	4,257	17,120
1841	1,450	..	1,643	186	6,000	243	5,850	4,243	19,421
1842	1,373	..	1,565	144	6,400	373	6,450	4,127	21,552
1843	1,299	..	1,494	140	6,700	237	7,000	4,078	27,056
1844	1,274	..	1,408	112	3,000	298	7,850	3,968	22,767
1845	1,313	..	1,466	228	1,500	127	8,100	3,988	21,627
1846	1,298	..	1,456	138	1,500	74	8,410	4,031	32,885
1847	1,314	74	1,502	132	1,700	37	..	4,017	38,699
1848	1,175	57	1,375	48	1,700	85	9,641	3,947	37,140
1849	1,176	72	1,375	84	1,150	58	..	3,970	33,333
1850	1,141	106	1,294	198	600	36	..	3,998	33,773
1851	1,136	131	1,292	66	666	34	10,150	3,188	52,173
1852	1,134	133	1,281	114	200	43	10,300	3,078	20,609
1853	1,243	319	1,684	264	528	41	10,420	3,251	25,952
1854	1,200	138	1,368	126	612	95	10,587	3,171	22,661
1855	1,159	107	1,289	120	653	55	10,780	3,131	14,778
1856	1,216	197	1,519	156	761	47	10,832	3,204	16,184
1857	1,258	176	1,937	78	1,038	40	10,960	3,168	12,755
1858	1,318	221	2,102	105	438	31	11,062	3,246	25,747
1859	1,526	195	2,277	512	946	70	11,320	3,344	28,739
1860	1,961	298	3,577	397	2,178	114	11,517	3,518	28,011
1861	2,122	305	2,899	266	2,846	99	11,812	3,689	23,296
1862	2,296	242	3,127	239	3,178	109	12,026	3,797	27,215
1863	2,379	218	3,100	405	3,583	143	12,296	3,847	18,150
1864	2,425	215	3,253	222	4,516	116	12,700	3,902	17,276
1865	2,435	154	3,467	235	4,804	137	13,000	3,895	18,253
1866	2,435	157	3,488	299	5,486	150	13,337	3,891	17,067
1867	2,431	141	3,467	208	5,732	140	13,800	3,823	17,211
1868	2,446	184	3,534	297	6,396	119	14,100	3,812	16,417
1869	2,368	165	3,485	238	6,653	232	14,669	3,792	15,947

* Including Annual Subscriptions, Entrance Fees, Donations, Legacies, and Interest on Funded Property also the Grant from Government, commencing in 1857.

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Yorke, Philip James, FRS. Col. late Sco. Fus. Gds. (3*l.*)
Yorke, Reginald Rear-Adm.
Young, Allen W. Lieut. R.N.R. (9*l.*)
Young, H. B. Rear-Admiral
Young, W. L. M. CB. Superintendent of Stores (3*l.*)
Yule, James Commr. R.N. (3*l.*)

HONORARY MEMBERS.

BYE-LAWS.—SECTION X.

His Majesty the KING of the NETHERLANDS.
His Royal Highness Prince Alexander of the Netherlands.
His Royal Highness the Count de Paris.

The Hon. Lady Grey.
Mrs. Smyth.
Lady Grey.
Mrs. Egerton Hubbard.
Mrs. Alexander.
Mrs. Jackson.

Lady Mulcaster.
Mrs. Somerville.
Miss Mary Somerville.
Miss Martha Somerville.
Lady Emily Ponsonby.

Lady Gomm.
Lady Taylor.
Mrs. Hayes.
Miss Roberts.
Lady Franklin.

Abel, F. A. Esq. FRS.
Addams, Robert, Esq.
Anderson, John, Esq., C. E., Superintendent of Machinery, Royal Arsenal, Woolwich.
Arrow, Capt. Sir Fred., Kt., Trinity House
Baldock, William, Jun., Esq.
Bentham, George, Esq. FRS. LS. and HS.
Bentley, Richard, Esq.
Bourne, John, Esq. CE.
Casher, E. Esq.
Close, Mark C. Captain
Drummond, A. Robert, Esq.
Drummond, Charles, Esq.
Drummond, George, Esq.
Drummond, John, Esq.
Fairbairn, W. Esq. LLD., &c.
Fergusson, James, Esq. FRAS.
Filose, Capt., Scindia's Service
Galton, Fran., Esq. MA. FRS. FRGS.
Gordon, A. F. Esq.
Gould, John, Esq. FRS., &c. &c.
Grey, *Right Hon. Sir* George, *Bt.* GCB. MP.
Hardwick, Philip, Esq. FRS.
Haverfield, *Rev.* T. T. BD.
Hope, *Rev.* F. W.
Jones, Owen, Esq.
Laird, John, Esq. MP.
Latham, John, Mr.
Mallet, R. Esq. CE. FRS., &c.
O'Byrne, W. R. Esq., Author of "Naval Biography"
Oliphant, Laurence, Esq. FRGS.
Sandwith, Humphrey, Esq. CB. MD. DCL.
Sedgwick, Professor, FRS., &c.
Smyth, C. Piazzi, Esq., Astro. Roy. for Scotland
Smyth, W. Warrington, Esq. FRS.
Stephens, Andr. John, Esq. FRS. Standing Counsel to the Institution
Taylor, G. L. Esq. Architect of the Institution
Tobin, Geo. Webb, Esq.
Wigram, Clifford, Esq.
Williams, J. Esq.
Wyatt, James, Esq.

CORPS DIPLOMATIQUE.

Austria.—Apponyi, Count, Ambassador Extraordinary and Plenipotentiary.
Bavaria.—Hompesch, Count, Ambassador Extraordinary and Minister Plenipotentiary.
Belgium.—Beaulieu, Baron de, Envoy Extraordinary and Minister Plenipotentiary.
B. M. de Fosselaert, Counsellor.
Van de Velde, A. M., First Secretary.
Brazils.—Areas, Almeida, Chev. de, Envoy Extraordinary and Minister Plenipotentiary.
Denmark.—Bulow, de, F., General, Envoy Extraordinary and Minister Plenipotentiary.
France.—Valette, de la, Marquis, Ambassador Extraordinary and Plenipotentiary.
Tonnerre, Viscount Clermont de, Attaché.
Dumas-Vence, Captain, Naval Attaché.
Corbin, C., Commandant, Military Attaché.
Italy.—Cadorna, Cavaliere Carlo, Envoy Extraordinary and Minister Plenipotentiary.
Maffei, Count, First Secretary.
Prussia and North German Confederation.—Bernstorff, Count Von, Ambassador Extraordinary and Minister Plenipotentiary.
Russia.—Brunnow, Baron de, Ambassador Extraordinary and Minister Plenipotentiary.
Spain.—Villanueva, Don Manuel Rauces y, Ambassador Extraordinary and Minister Plenipotentiary.
Sweden and Norway.—Hochschild, Baron Carl, Envoy Extraordinary and Minister Plenipotentiary.
Turkey.—Musurus Pacha, H. E., Ambassador Extraordinary and Plenipotentiary.
United States of America.—Motley, Hon. John Lothorp, Envoy Extraordinary and Minister Plenipotentiary.
Baudeau, A., General, Assistant Secretary of Legation.

FOREIGN OFFICERS.

Bode, Baron de, Major-Gen., Imp. Russ. Ser.
Cecille, Admiral, French Navy.
Da Cunha, C. P. Capt., Port. Navy.
Graham, J. D. Major, U.S. Topograph. Eng.
Lampo, A. Cavaliere, Capt. Italian Navy.
Maury, Capt. late United States Navy.
Pirche, Colonel, the Baron de, French Army.
Tchitchagoff, Admiral, Imp. Russian Navy.
Todleben, Lieut.-General E. de Imp. Russian Service.
Usedom, Baron Von.
Wright, Lieut.-Col. Commanding 5th Prussian Dragoons.

CORRESPONDING MEMBERS.

Novitzky, N. de, Major-General, Aide-de-Camp to H.M. the Emperor, Agent Militaire de Russie à Londres.
Bonnevie, F. Lieut., Norwegian Royal Guard.
Ekeloff, T. A. Lieut. Royal Swedish Navy.

Officers wishing to become Members of the Royal United Service Institution can copy one of the subjoined Forms, and inclose the copy to the Secretary:—

FORM FOR BECOMING AN ANNUAL SUBSCRIBER.

_____187

IT is my desire to become a Member of the Royal United Service Institution; and I hereby request and authorise my Agents [or Bankers], Messrs. _____, to pay my Entrance Fee and Annual Subscription now, and as it becomes due on the 1st January in each year, to the Secretary of the Institution.

_____Signature.

_____Qualification for Membership.

FORM FOR BECOMING A LIFE SUBSCRIBER.

IT is my desire to become a Life Member of the Royal United Service Institution; and I hereby authorise my Agents [or Bankers], Messrs. _____, to pay my Entrance Fee and Life Subscription to the Secretary of the Institution.

_____Signature.

_____Qualification for Membership.

Entrance Fee—ONE POUND.

Annual Subscription—ONE POUND, which entitles a Member to receive the Journal; or TEN SHILLINGS without the Journal.

Life Subscription TEN POUNDS (including Entrance Fee), which entitles a Member to receive the Journal, or SIX POUNDS (in addition to the Entrance Fee) without the Journal.

Form of Bequest.

I give and bequeath unto THE ROYAL UNITED SERVICE INSTITUTION, *situated in Whitehall Yard, London, the sum of*

to be applied in and towards carrying on the designs of the said Institution, such Legacy to be paid out of such part of my personal Estate not specifically bequeathed as the law permits to be appropriated by Will to Charitable Purposes.

ROYAL UNITED SERVICE INSTITUTION.

DESIGN.

THE promotion of Naval and Military Art, Science, and Literature is the object of the ROYAL UNITED SERVICE INSTITUTION.

The principal means by which this object is sought to be obtained are,—the formation of a Library containing Historical, Scientific, and Professional Works, Maps, Charts, and Plans; the Delivery of Lectures; the Exhibition of Inventions; and the Publication of a Journal; a Collection of Arms of all Nations; and a Museum, which shall serve as a Central Repository for Objects of Professional Information, and for Trophies and Relics, &c., connected with distinguished Officers, and Naval and Military Operations.

BYE-LAWS.

SECTION I.

1. There shall be Patrons and Vice-Patrons.

2. PATRONS: The Sovereign and the Royal Consort.

3. VICE-PATRONS: Limited to Members of the Royal Family; Officers eminently distinguished in the Service of the Country; and Members selected by the Council as having been benefactors to the Institution.

4. The following Public Officers shall be Vice-Patrons during their continuance in office:—

1. The First Lord of the Treasury.
2. The Secretary of State for the Home Department.
3. The Secretary of State for Foreign Affairs.
4. The Secretary of State for the Colonies.
5. The Secretary of State for War.
6. The Secretary of State for India.
7. The First Lord of the Admiralty.
8. The Commander-in-Chief of Her Majesty's Forces.
9. The Lord-Lieutenant of Ireland.
10. The Viceroy and Governor-General of India.

SECTION II.—Composition.

1. Princes of the Royal Blood; Lords Lieutenant of Counties; Governors of Colonies and Dependencies; Officers of the Army, Navy, Marines, Her Majesty's East Indian Military and Naval Forces, Militia, Yeomanry, Royal Naval Reserve, and Volunteer Corps, shall be entitled to become Members *without Ballot*, on payment of the Entrance Fee and Annual Subscription.

2. Ex-Governors of Colonies and Dependencies; Retired Officers, not previously Members; Deputy Lieutenants of Counties; Civil Functionaries who are or have been attached to the Naval and Military Departments; also the Master, Deputy-Master, and Elder Brethren of the Trinity House; and Navy and Army Agents; shall be *eligible* to become Members by *Ballot*.

3. Gentlemen above the age of *fifteen*, whose names are on the List of the Commander-in-Chief for Commissions in the Army, or who are probationary for offices connected with the Naval and Military Professions, shall be *admissible*, by *Ballot*, to become Provisional Members from year to year, on payment of the Annual Subscription; after they obtain their appointments they shall become Ordinary Members on payment of the Entrance Fee.

4. The Candidates referred to in Articles 2 and 3 must be recommended by Two Members of the Institution on their personal knowledge; the Lists, signed by the Secretary, shall be put up in the Library or Reading-room Fourteen Days before they are submitted for Election to the Council of Management specially assembled.

SECTION III.—Government.

1. The Government shall consist of a President and Twelve Vice-Presidents, and a Council of Management composed of Twenty-four Members.

2. The President of the Institution shall be elected by a General Meeting of the Members, and shall be a Member of the Council, *ex-officio*.

3. The Vice-Presidents shall be elected by the Council, of which they shall be *ex-officio* Members.

4. The Council shall be elected by the General Meeting: Eight Members shall annually go out by rotation; Three of the Members going out shall be eligible to be re-elected. The Council shall submit to the Annual General Meeting a list of

not less than ten names from which the vacancies may be filled. Vacancies that occur during the year shall be filled up at the discretion of the Council; the Members so elected going out by rotation as the Members would have done whose position they have been elected to fill.

5. After the annual meeting, the Council shall select a Chairman and Vice-Chairman for the ensuing year, one of whom, or a Vice-President, shall preside at its meetings, except when the President of the Institution attends.

6. Five Members of the Council shall constitute a quorum.

7. Two Vice-Presidents shall undertake the office of Visitors, who shall make a quarterly inspection of the Institution and its affairs, and report thereon to the Council.

8. The Council shall have the custody of the Common Seal of the Corporation, and shall have full power and authority to affix the same to all deeds, documents, papers, and writings in the name and on behalf of the Corporation.

9. The Council shall appoint a Secretary and Curator, and such other officers, attendants, and servants, as they shall think necessary for the purposes of the Institution, with full power to suspend or dismiss the same, and no such officer, attendant, or servant shall, either directly or indirectly, accept, receive, or take, from any person or persons whatsoever, any gratuity, fee, or reward whatsoever, other than and except the salary, wages, or emolument allowed by the Council.

SECTION IV.—Subscription.

1. *An Entrance* Fee of *One Pound* shall be paid by all Members on joining the Institution.

2. *Annual Subscriptions* shall be due on the 1st of January in each year: Subscribers of not less than *One Pound* a-year shall, after the 1st of January, 1860, be entitled to receive the Journal from the date of their becoming Members.

3. Annual Subscribers of *Ten Shillings* shall, after the 1st of January, 1860, receive as heretofore the Annual Report, but not the Journal.

4. After the 1st of January, 1860, all Subscribers of One Pound a-year shall, while serving on Foreign Stations, have their Subscription reduced to *Ten Shillings* a-year, commencing on the 1st of January succeeding their embarcation, if they express their wish to that effect in writing to the Secretary.

5. *Life Subscriptions.* After the 1st of January, 1860, the

payment of a sum of *Nine Pounds*, in addition to the Entrance Fee, shall constitute a Member for Life, who shall be entitled to receive the Journal from the time of his becoming a Member.

6. *Life Subscribers* of *Six Pounds*, in addition to the Entrance Fee, shall receive as heretofore the Annual Report, but not the Journal.

7. Annual Subscribers of Ten Shillings and Life Subscribers of Six Pounds, while serving abroad, shall be entitled during such service to receive the current numbers of the Journal, on notifying their wish to that effect to the Secretary in writing.

*8. All Members joining the Institution on or after January 1st, 1870, shall be entitled to receive the Journal from the date of their becoming Members. They shall pay an Entrance Fee of £1, and an Annual Subscription of £1, whether they are at Home or Abroad; or they may become Life Members by a payment of £9 in addition to the Entrance Fee.

9. Members who join the Institution on or after the 1st October in any year shall not be charged the ensuing Annual Subscription on the 1st of January.

10. Members failing to pay their Annual Subscriptions shall have their names removed from the List of Members, at the discretion of the Council.

11. Members whose names have been struck off for non-payment of their Subscriptions after repeated applications, shall be re-admissible only on payment of arrears from the date of last payment.

SECTION V.—Funds and Expenditure.

1. The management of the property, receipts, and payments of the Institution shall be confided to the Council, who shall authorise every payment by an order, signed by the Chairman at the Meeting, and another Member of Council present, and countersigned by the Secretary.

2. The Royal United Service Institution neither shall nor may make any dividend, gift, division, or bonus in money, unto or between any of its Members out of its present property, or out of any property which it may hereafter acquire, and the whole of its property, both present and future, shall be exclusively applied for carrying into effect its design as an establish-

* This Rule (8) was passed at a Special General Meeting, held on 5th July, 1869.

ment for the promotion of Naval and Military Art, Science, and Literature.

3. The funds of the Institution and all Life Subscriptions and Legacies shall be invested in the name of the Corporation in eligible securities, to be selected by the Council.

4. All cash received on behalf of the Institution by the Secretary shall be paid by him to the Bankers of the Institution.

SECTION VI.—Auditors.

1. There shall be Three Auditors, not Members of the Council, who shall be elected by the General Annual Meeting to audit the accounts, one of whom shall annually go out by rotation, but shall be eligible for re-election.

2. Two Auditors shall be a quorum.

3. Vacancies that occur other than those caused by the Auditor going out by rotation shall be filled up at the discretion of the Council; the Auditor so elected going out in rotation as the Auditor would have done whose position he has been elected to fill.

4. The Auditors shall meet and examine and sign the yearly accounts, adding thereto any remarks and making such inquiries as they may deem proper.

5. After the Audit, and at least Fourteen Days before the General Annual Meeting, the Annual Report, with an abstract of the accounts and estimate of the probable receipts and expenditure for the ensuing year shall be printed and placed in the Library and Reading-Room, and may be obtained by the Members upon application to the Secretary.

SECTION VII.—General Meetings.

1. A General Meeting shall be annually held on the first Saturday in March; that day being considered the Anniversary of the Institution.

2. The Council may call a Special General Meeting, on giving fourteen days' notice—which notice must be suspended in the Library or Reading-Room, and advertised in two military papers, specifying the object or objects in contemplation, and explicitly stating that the discussion shall be strictly confined to those objects.

3. The Council shall call a Special General Meeting, on the written requisition of not less than Twenty-four Members,

within one calendar month from the date of such requisition, subject to the notices and restrictions above mentioned.

4. At the General Meetings, in case of an equality of votes, the Chairman shall have a second or casting vote.

5. No Member shall be entitled to speak or vote at any General Meeting, or at any Special General Meeting, or at any adjournment thereof, unless he shall have paid his Subscriptions up to the day of payment next preceding such Meeting.

6. That any General or Special General Meeting, finding the current day insufficient for its intended purpose, may adjourn to the succeeding or any future day or days, until the business be concluded.

7. That no business shall be transacted at any Annual General Meeting other than that submitted by the Council, or by the direction of the Council, unless notice thereof be suspended in the Library or Reading-Room at least Fourteen Days prior to the day appointed for such Annual General Meeting, specifying the object or objects in contemplation, to which objects the discussion must be strictly confined.

SECTION VIII.—Making or Repealing Bye-Laws.

Should it be proposed to make, alter, or repeal a Bye-Law, the proposition to such effect, signed by the proposer and seconder, shall be suspended in the Library or Reading-Room for Fourteen Days; after which the question shall be determined by a majority of at least two-thirds of the Members present at the next General Meeting.

SECTION IX.—Mode of Voting.

All questions to be decided by a show of hands, unless a Ballot be demanded.

SECTION X.—Honorary Members.

1. The Council shall have the power of admitting Honorary and Corresponding Members.

2. Foreigners of distinction may be admitted as Honorary and Corresponding Members.

3. Eminent Individuals and Benefactors to the Institution, not otherwise eligible, may be admitted as Honorary Members.

4. The Diplomatic Body shall be invited to become Honorary members; and shall be privileged to submit the names of foreign noblemen and gentlemen, resident in England, to the Council, in order that the same courtesy may be extended to them, for the space of Three Months: this privilege to be renewed to such strangers, if desired, on the written application of their respective Ambassadors, or at the recommendation of of some Member to whom they may be personally known.

5. Foreign Naval and Military Officers may be admitted as Honorary and Corresponding Members.

6. Ladies who contribute to the Institution may be admitted as Honorary Members.

SECTION XI.—Contributions.

The name of each Contributor shall be recorded, with a specification of the gift.

SECTION XII.—Hours of Reception—Visitors.

1. The Museum of the Institution shall be open daily (Sundays excepted) from 11 to 5 in Summer, and from 11 to 4 in Winter.* Printed tickets for the admission of Visitors are available every day except Friday, on which day a personal introduction by a Member is necessary. The names of Visitors to be inscribed in a book kept for the purpose.

2. The Libraries and Reading-Rooms shall be kept open (Sundays excepted) for the use of Members only, till 8 in the evening, or to a later hour, at the discretion of the Council.

3. The Museum shall be closed to Visitors when necessary, at the discretion of the Council.

SECTION XIII.—Expulsion.

1. Any Member who shall be removed from the Public Service for causes affecting his character shall cease to belong to the Institution.

* Winter months—October to March inclusive.

2. In case the Council shall think it expedient to submit the conduct of any Member to the judgment of a General Meeting, the Council shall call a Special General Meeting; and in the event of its being voted at that Meeting, by two-thirds of the Members present (to be decided by ballot), that such Member should be removed from the Institution, then, in that case, the name of such Member shall accordingly be erased from the List of Members, and he shall cease to belong to the Institution.

3. In case the Member is a Life Subscriber, he shall forfeit all claim on the Institution upon his expulsion.

(4342) Harrison & Sons, Printers in Ordinary to Her Majesty, St. Martin's Lane.

ROYAL
UNITED SERVICE INSTITUTION.

Charter of Incorporation.

Victoria by the Grace of God of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, **To all to whom** these presents shall come, **Greeting:**

Whereas our right trusty and right entirely beloved Cousin and Councillor, Algernon Percy, Duke of Northumberland, Knight of the Most Noble Order of the Garter, Vice-Admiral, and others of our loving subjects, have, by their Petition, humbly represented unto us that they are Members of a Society, established in the year one thousand eight hundred and thirty-one, under the title of "The Naval and Military Library and Museum," but since called "The United Service Institution," of which His late Majesty King William the Fourth was the founder;

That such Society has sedulously encouraged

and extended Naval and Military Science and Literature, and that it would further tend to the promotion and advancement of Naval and Military Science and Literature if we granted to the said Algernon Percy, Duke of Northumberland, and to those who are now Members of the said Society, our Royal Charter of Incorporation;

Now know ye, That We, being desirous of encouraging a design so laudable and salutary, of our especial grace, certain knowledge, and mere motion, **Have** willed, granted, and declared, and **Do** by these presents, for Us, our heirs and successors, will, grant, and declare, that the said Algernon Percy, Duke of Northumberland, and such other of our loving subjects as now are Members of the said Society, or shall from time to time become Members thereof, according to such regulations or bye-laws as shall be hereafter framed or enacted, and their successors, shall, during such time as they shall respectively continue to be such Members, be by virtue of these presents one body politic and corporate, by the name of "THE ROYAL UNITED SERVICE INSTITUTION," and for the purposes aforesaid and by the name aforesaid shall have perpetual succession and a common seal, with full power and authority to alter, vary, break, and renew the same at their discretion, and by the same name to sue

and be sued, implead and be impleaded, answer and be answered unto, in every court of Us, our heirs and successors, and be for ever able and capable in the law to purchase, receive, possess, hold, and enjoy, to them and their successors, any goods and chattels whatsoever, and as well those as now belong to the said Institution as those which may be hereafter acquired; and also to be able and capable in the law (notwithstanding the Statute of Mortmain) to take, purchase, hold, and enjoy to them and their successors a Hall or House, and any such messuages, lands, tenements, or hereditaments whatsoever as may be necessary for carrying out the purposes of the said Society, the yearly value of which, including the site of the said hall or house, shall not exceed in the whole the sum of two thousand pounds, computing the same respectively at the rack-rent which might have been gotten for the same respectively at the time of the purchase or acquisition thereof; and to act in all the concerns of the said body politic and corporate as effectually, to all intents and purposes, as any other of our liege subjects in our said kingdom not being under any disability might do in their respective concerns.

And We DO HEREBY GRANT our especial licence and authority unto all and every person and persons,

bodies politic and corporate, otherwise competent, to grant, sell, alien, and convey in mortmain unto and to the said body politic and corporate and their successors, any messuages, lands, tenements, and hereditaments, not exceeding such annual value as aforesaid.

And Our will AND PLEASURE IS, and we do further will and declare, that there shall be Patrons and Vice-Patrons, and a President and Vice-Presidents, of the said Institution, and that the said Algernon Percy, Duke of Northumberland, shall be the first President under this our Royal Charter of Incorporation, and that not more than Twenty-four nor less than Twelve Members, to be chosen by a General Meeting of the said Society, shall be the Council of the said body politic and corporate, of which the aforesaid President and Vice-Presidents shall be ex-officio Members; and, until such Members of the Council shall be elected, the present Members of the Council of the said Institution shall be the Council of the said body politic and corporate.

And We DO FURTHER WILL AND DECLARE, That there shall be a General Meeting of the Members of the said Society once in each year or oftener, and that if necessary the same shall be adjourned from time to time, and that the said General Meetings and the Council shall have the entire direction and manage-

ment of the concerns of the said body politic and corporate, in the manner and subject to the regulations hereinafter mentioned.

And We DO FURTHER WILL AND DECLARE, That the said General Meetings shall from time to time make and establish such bye-laws, and vary, and alter, and revoke the same, as they shall deem to be useful and necessary, for the election of President, Vice-Presidents, and Council, and for the regulation of the said body politic and corporate, for the admission and expulsion of Members and of honorary and foreign Members, so that such bye-laws be not repugnant to these presents, or to the laws and statutes of this our realm; and shall and may also enter into any resolution and make any regulation respecting the affairs of the said body politic and corporate that may be necessary and proper, and shall not be repugnant to these presents, or to the said laws and statutes.

And We DO FURTHER WILL AND DECLARE, That the General Meetings and adjourned General Meetings shall take place at such time as may be fixed by the said Council, and that the present rules, regulations, or bye-laws of the said Society, so far as they are not inconsistent with these presents, shall continue in force until the same shall be altered by a General Meeting.

And We DO FURTHER WILL AND DECLARE, That notwithstanding anything herein contained, the Council shall have the sole management of the income and funds of the said body politic and corporate, the appointment of Secretary, Curator, and such officers, attendants, and servants as the Council shall think necessary or useful; and also the entire management and superintendence of all the other affairs of the said Society; and shall and may, but not inconsistently with or contrary to the provisions of this our Charter, or any existing bye-law or laws, or the laws and statutes of this our realm, do all such acts and deeds as shall appear to them necessary for carrying into effect the objects and views of the said body politic and corporate.

Provided always, and we do further will and declare, That the Council shall from time to time, and at least once in each year, render to a General Meeting a full account of their proceedings, and that every Member of the Society may at all reasonable times, to be fixed by the Council, see and examine the accounts of the receipts and payments of the said body politic and corporate.

And We DO FURTHER WILL AND DECLARE, That no sale, mortgage, incumbrance, or other disposition of any messuages, lands, tenements, or hereditaments belonging to the said body politic and

corporate shall be made, except with the approbation and concurrence of a General Meeting.

And We DO FURTHER WILL AND DECLARE, That it shall be lawful for the Council of the said Institution, with the approbation and concurrence of a General Meeting from time to time to appoint any persons to be Trustees of any part of the property of the said body politic and corporate, and to make, or direct to be made, any conveyance or transfer to such Trustees.

In witness whereof we have caused these our Letters to be made Patent.

Witness Ourself, at Our Palace at Westminster, this twenty-second day of February, in the twenty-third year of our reign.

By Her Majesty's command,

Edmunds.

Seal.

CATALOGUE

OF

BOOKS AND PAMPHLETS

PRESENTED BY

ESTHER, LADY RADSTOCK,

TO THE

Royal United Service Institution,

1869.

CATALOGUE OF BOOKS AND PAMPHLETS,

Presented by ESTHER, LADY RADSTOCK.

ALARM of an Invasion from Spain in 1596. Opinions of the Earl of Essex, Lord Burleigh, Sir Walter Raleigh, and others, and the measures proper to be taken on that occasion.

ALMANACH, Impérial, 1811. 8vo. Paris.

AMERICAN State Papers, relative to the War between the United States and Great Britain, 1795.

ARMADA. The Deliverance from the Spanish Invasion in 1588; also the Deliverance of Church and State from the Powder Plot, 1605. 18mo. London, 1657.

BARBARY, Voyages to, with an Account of the Country; the Sufferings of the Christian Slaves; a Description of Mequinez, Oran, and Alcazar; Journal of the Siege of Oran; Maps and Plans. 2nd edition. 8vo. London, 1736.

BARROW, John. The Naval History of Great Britain, with Lives of the most Illustrious Admirals and Commanders from the earliest account of time to the year 1761. 2nd edition. 4 vols. 12mo. London, 1776.

BARROW, Sir John, Bart., F.R.S. The Life of Richard Earl Howe, K.G., Admiral of the Fleet and General of Marines. 8vo. London, 1838.

BARTHELEMY, M. History of Boulogne-sur-mer, from Julius Cæsar to 1825. 12mo. Paris, 1825.

BERCHTOLD, Count Leopold. An Essay to direct the inquiries of Travellers, with observations on the means of preserving life, health, and property in Journies by Land and Sea; and a Catalogue of Travels from the earliest times to 1787. 2 vols. 8vo. London, 1789.

BIDEN, Christopher, late H. E. I. Co.'s Service. Naval Discipline. Subordination contrasted with Insubordination; the necessity for Naval Discipline in the Merchant Service. 8vo. London, 1830.

BLAKE. Life of Robert Blake, of Bridgwater. 12mo. London.

BLIGH, William, Lieut. The Mutiny of the Bounty, 1790; also Letter from Viscount Melville to the Right Hon. Spencer Percival, relative to a Naval Arsenal at Northfleet, 1810: and Remarks on heaving down a 72 Gun Ship; and the method pursued by H.M.S. "Melville," in Chusan Harbour, and H.M.S. "Medina," in Port Leone. By Captain Robert Harris, R.N.

BONAPARTE in Egypt, copies of original Letters from the Army of, intercepted by the Fleet under Lord Nelson. Also copies of the London Gazettes containing accounts of the Victories over the French Fleet by Lord Howe, 1st June, 1794; over the Spanish Fleet by Sir J. Jervis, 14th February, 1797; over the Dutch Fleet by Admiral Duncan, 11th October, 1797; and over the French Fleet by Sir H. Nelson, 1st August, 1798. 8vo. London, 1798.

BOUGARD, Le Sieur. The Little Sea Torch; or Guide for Pilots on the Coasts of England, Ireland, France, Spain, Portugal, Italy, Sicily, Malta, Corsica, Sardinia, and Barbary; with Plans of Harbours and Table of Soundings. Translated by J. T. Serres. Folio. London, 1801.

BOURDÉ, Monsieur. Manuel des Marins, ou Dictionnaire des Termes de Marine. 8vo. 1773.

BRANDT, Gerard. La Vie de Michel de Ruiter, Amiral de Hollande, où est comprise l'Histoire Maritime des Provinces Unies, depuis 1652 jusques à 1676. Folio. Amsterdam, 1698.

BRENTON, Edward Pelham, Captain R.N. The Naval History of Great Britain,

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